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US EPA RECORDS CENTER REGION 5



498166

Qualifications and Experience

Environmental Services



WW Engineering & Science

We appreciate your interest in our qualifications and experience. As you will see, WW Engineering & Science is a large environmental and engineering consulting firm with a broad range of project experience and a wealth of technical and managerial talent. With over 500 employees, WW Engineering & Science is the largest environmental consulting firm based in Michigan and is the state's second largest engineering firm overall.

Our firm was founded back in 1924 as Williams & Works. Over the years, we have experienced strong growth, and most of it has come through ongoing assignments and referrals from a group of long-standing clients. We sincerely hope that we can develop the same kind of positive working relationship with your organization. You will find, as others have, that we sustain high levels of professional service over the long-haul and that we serve as strategic advocates for our clients.

We extend a warm invitation to you and your associates to visit our offices and talk with our staff members. We will see that you meet the people best suited to discuss whatever proposed project or concern you might have.

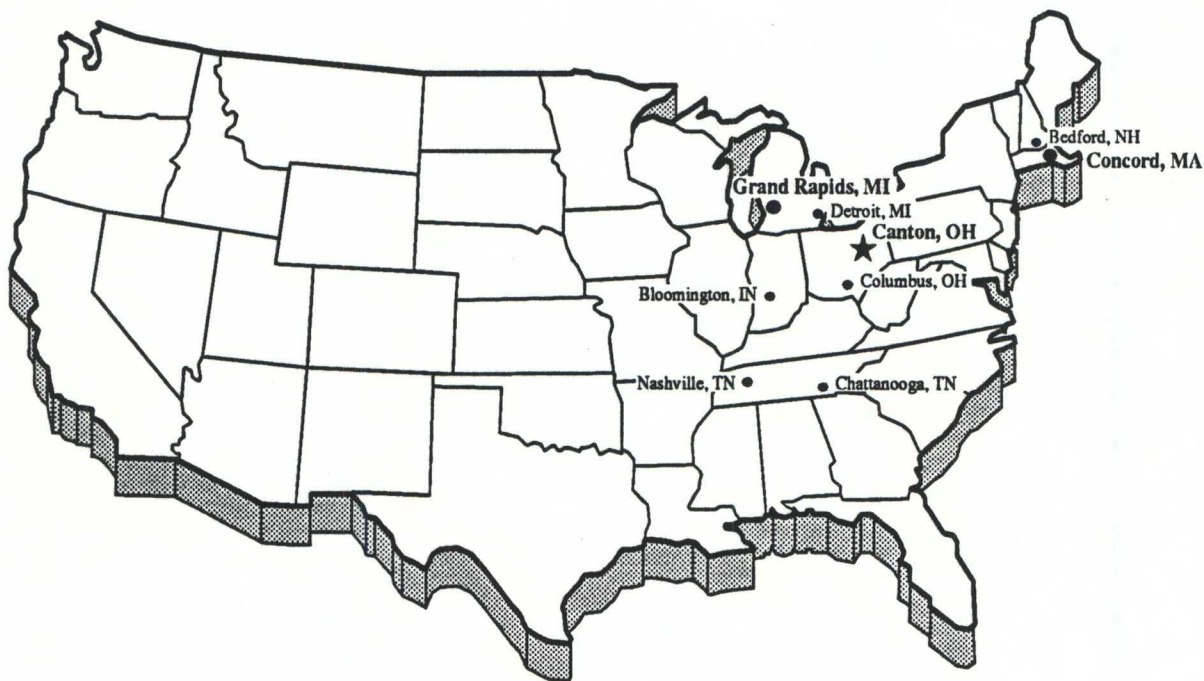


PARENT COMPANY ORGANIZATION

With engineering roots that date back to 1924, WW Engineering & Science today is a large, full-service engineering and environmental consulting firm. WW Engineering & Science provides complete services in environmental consulting, laboratory analysis, engineering, and construction management. Headquartered in Grand Rapids, Michigan, WW Engineering & Science is the Great Lakes flagship company of the Summit Environmental Group, Inc. of Canton, Ohio. We also work with HMM, Inc., our associate flagship headquartered in Concord, Massachusetts. Together we have over 700 professionals committed to providing reliable and responsive services to our clients nationwide.

WW Operation Services provides complete contract operations and management of municipal and industrial environmental control facilities. They provide these services throughout the eastern half of the U.S. and coordinate client needs closely with WWES and HMM.

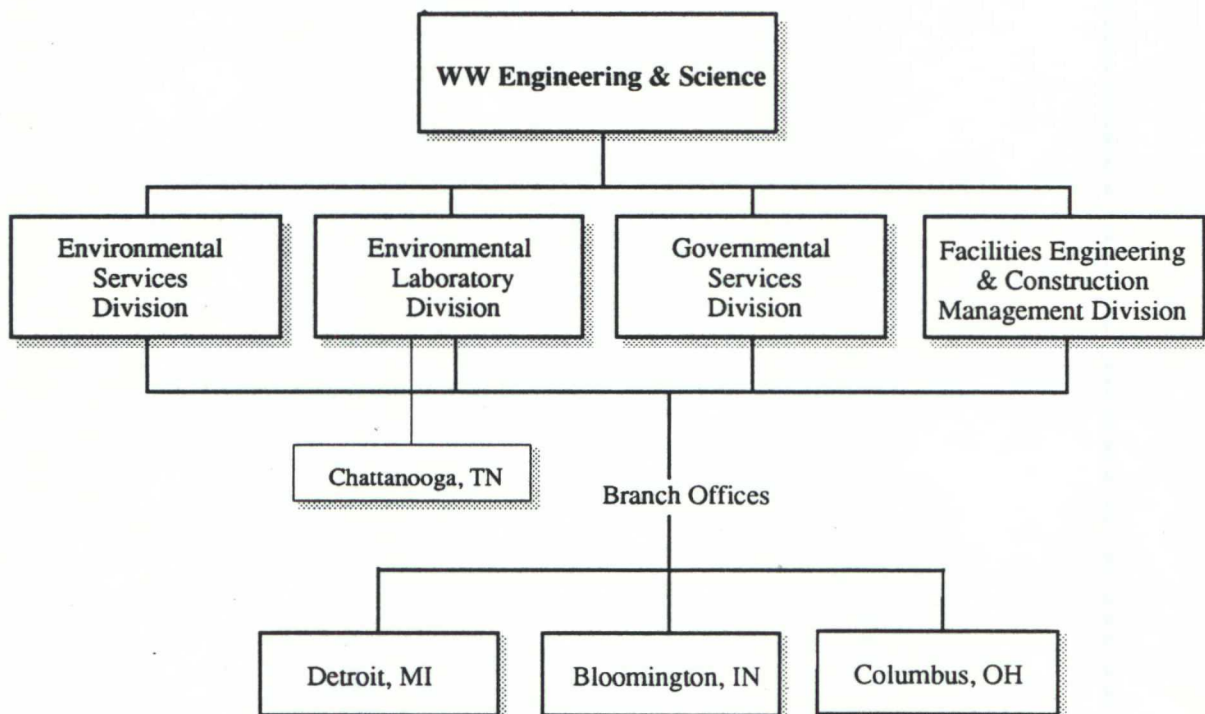
Geographical Resources



WW ENGINEERING & SCIENCE ORGANIZATION

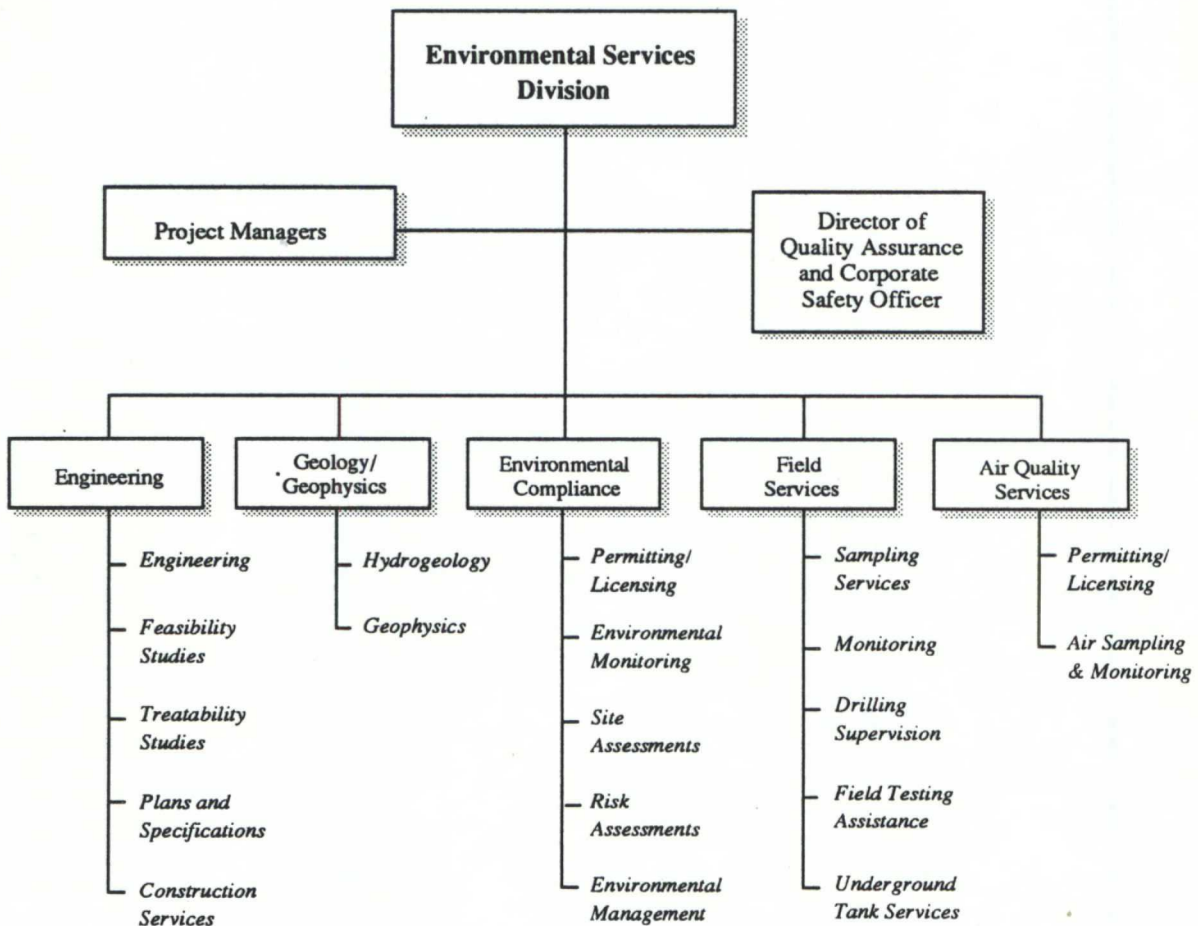
The four divisions and branch offices of WW Engineering & Science and WWW Operation Services have a combined staff of over 600 people. All of our divisions share common overall corporate management and support services. They work closely together and readily utilize each other's specialized technical expertise.

The Environmental Services Division is a multidisciplinary group of engineers, geologists, chemists, and environmental scientists. The Environmental Laboratory Division is a state-of-the-art analytical laboratory. The Facilities Engineering & Construction Management Division provides detailed engineering design and comprehensive construction management services to all of the divisions and to their industrial clients. The Governmental Services Division (founded as Williams & Works in 1924) provides civil engineering, planning, and surveying services in support of various public works projects.



ENVIRONMENTAL SERVICES ORGANIZATION

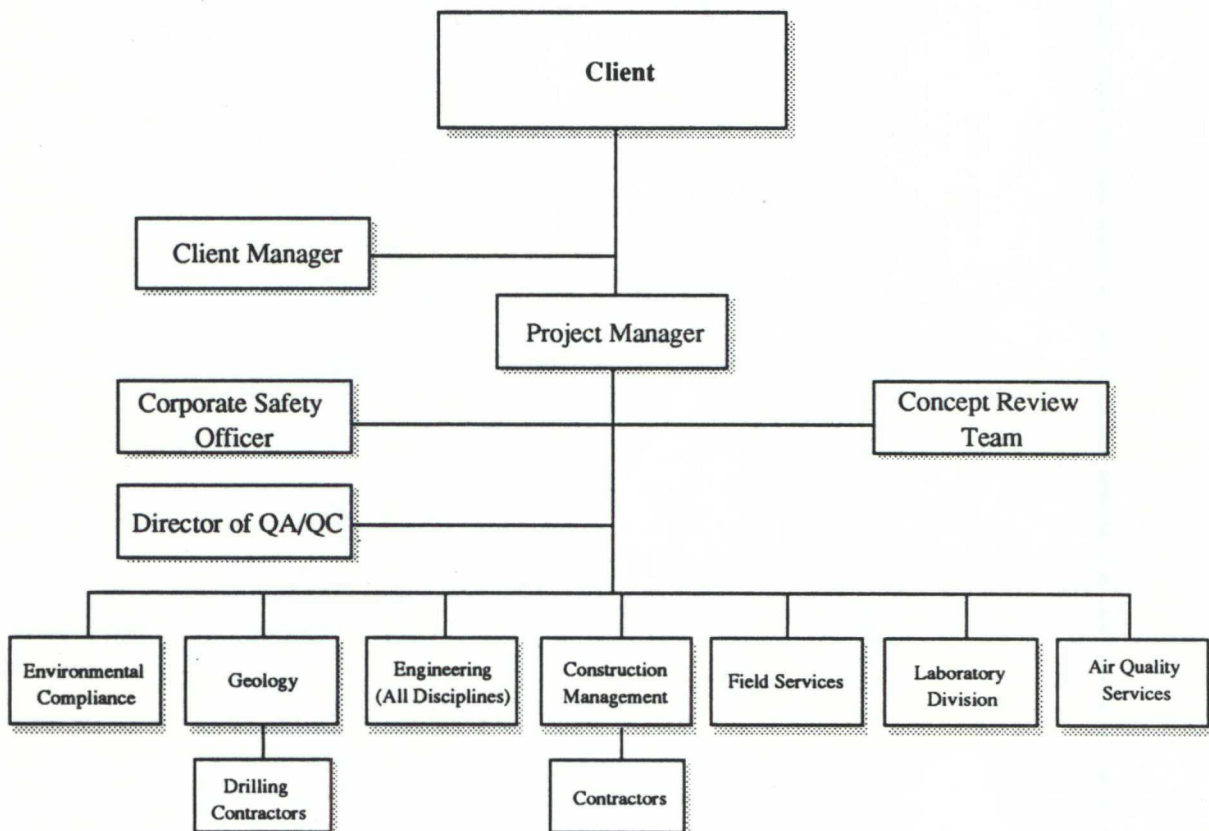
Much like the firm as a whole, our Environmental Services Division maintains a highly diversified technical staff, from which it assembles multidisciplinary, or cross-functional, project teams to meet the objectives of each particular project. As the chart indicates, our environmental services are broad and deep. We have performed projects ranging from initial environmental investigations and assessments to the design and construction of full-scale remediation systems.



PROJECT MANAGEMENT ORGANIZATION

Within our Environmental Services Division, Project Managers work in a separate group reporting directly to the President of the Division. They are empowered to draw on the expertise of people from any of our different departments or divisions. Project Managers also utilize the expertise of the Corporate Safety Officer and the Director of Quality Assurance. A Concept Review Team is available for cost analyses, value analyses, brainstorming, and advice at any phase of a project's life.

Drilling services are usually the only subcontracted services during subsurface or remedial investigation, and this is performed directly under the supervision of our field professionals. When we are involved in turnkey construction or remediation, specialized subcontractors report to the Project Engineer and Construction Manager. Major design/build or turnkey construction phases may involve a new Project Manager and a specialized engineering/construction team from our Facilities Engineering and Construction Management Division. With large projects, we assign responsibility for all financial obligations to a Billing Manager. In all cases, the client has direct access at any time to a Client Manager--usually a principal--for instant response to any questions or concerns about a project.



ENVIRONMENTAL SERVICES

WW Engineering & Science offers a complete range of environmental services from initial investigations to turnkey remediation or construction. We are capable of taking a project at any phase and carrying it to completion.

Hydrogeology/Geophysics

Back in the mid 1970's, WWES was one of the first general consulting engineering firms in the nation to establish a strong hydrogeology capability. At that time, Williams & Works had pioneered the use of low cost aerobic and anaerobic treatment lagoons and land treatment systems for smaller, rural municipalities and industry. Detailed hydrogeologic studies were required to determine leakage rates and characteristics and the transport and fates of pollutants in the subsurface environment. In the late 70's, this led us to expand into the infant hazardous waste/remediation consulting business, supported by our laboratory. Today we maintain a very strong geology and geophysical group supported by over 40 hydrogeologists and geophysicists - most with advanced degrees and specializations.

Our geological and geophysical experience includes:

- *Macro and Micro Hydrogeological Investigations*
- *Contaminated Soils Investigation*
- *Computer Ground Water Flow Modeling*
- *Solute Transport Modelling*
- *Background, Ground Water Quality Determination*
- *Magnetometer, Electromagnetic, Resistivity, GPR, and Seismic Surveys*
- *Borehole Logging (All techniques and interpretations)*
- *Buried Structure Mapping*
- *Contaminant Plume Identification and Tracking*
- *Well Field Designs*
- *Recharge Field Designs*
- *Containment Designs*
- *Well Field Management Programs*
- *Ground Water Discharge Permits*
- *Litigation Support*
- *Expert Testimony*



Environmental Engineering

The professional engineering tradition at WW Engineering & Science extends back to 1924 when T.O. Williams and F. D. Works opened a civil engineering office on Ionia Street in the bustling town of Grand Rapids, Michigan. Steady, consistent growth built an engineering practice that eventually encompassed all degreed engineering and design disciplines to serve Michigan's vibrant municipal and industrial market - focusing on civil/environmental engineering. As testimony to this growth and expertise, in the late 1970's and early 1980's, we were the consultants for very intricate and technical studies of the liquid sides of the one billion gallon per day Detroit Metropolitan Wastewater Treatment Plant and the 400 million gallon per day Pigs Eye plant serving the St. Paul/Minneapolis Metropolitan Area. Our work at Detroit to improve the hydrodynamics of their twenty-eight 300 foot diameter clarifiers - saving the City \$30 million - won us the Steuben Crystal for the highest international achievement in Consulting Engineering for 1980. It was natural for our engineers to team with our laboratory and hydrogeologists to design and implement ways to remediate hazardous waste sites. In 1982, we again won the Steuben Crystal for our work in cleaning up a Chessie System derailment and chemical spill at Woodland Park, Michigan. Bolstered by technology we licensed from Dow Chemical, USA, we became experts in designing, building, and operating ground water treatment systems to remove toxic organics from water. We pioneered the design of VOC emission controls for air stripping devices. We won a national award in 1984 for devising a way to remove styrene from 1.75 million gallons of 32% UAN liquid fertilizer to nondetectable (<4 ug/l) levels.

Today, our in-house engineering experience include:

- *Surveying*
- *Civil Engineering/Site Planning*
- *Remedial Investigations/Feasibility Studies*
- *Bench and Pilot Scale Treatability Work*
- *Site Remediation*
- *Process Chemical Engineering*
- *Physical/Chemical Treatment*
- *Biological Treatment/Bioremediation*
- *Solids Handling/Dewatering*
- *Pollution Prevention (Waste Minimization) Analyses*
- *Solid Waste Management Systems*
- *Solidification/Stabilization Designs*
- *Tank Systems*
- *Ground Water Treatment*
- *Process Wastewater Treatment*
- *Air Pollution Control*
- *Closure Plans*
- *Complete Design and Construction Services*



Environmental Compliance

With the passage of the federal Clean Water Act, the Resource Conservation and Recovery Act (RCRA), the Clean Air Act, CERCLA, SARA, and TSCA (along with all of their amendments, regulations, and state and local equivalents), it became clearly impossible for design professionals to stay abreast of the subtleties and nuances of environmental compliance. Consequently, in 1983, we established a group of professionals to do just this. Staffed by biologists, chemists, engineers, urban planners, toxicologists, and people with legal training, our Environmental Compliance Group now encompasses more than twenty people who make it their responsibility to understand the regulations and to assist our clients with environmental assessments, risk assessments, permits, and compliance demonstrations.

Their experience includes:

- *Permitting/Licensing*
- *Environmental Assessments*
- *Risk Assessments*
- *Environmental Sampling and Monitoring Programs*
- *Statistical Analyses*
- *Litigation Support*
- *Expert Testimony*
- *Pollution Prevention Analyses*

Field Services

WW Engineering & Science maintains a very strong and qualified environmental field services staff comprised of 18 OSHA-trained technicians with over 165 years of combined field experience. Many of our technicians have been with the firm for over 20 years. Seniors technicians have dedicated field service vehicles that are fully equipped for all required field sampling, monitoring, and contractor supervisory tasks.

These field personnel work closely with our professional staff to design and execute required field tasks such as:

- *Sampling - All mediums*
- *Install and maintain custom monitoring installations*
- *Perform construction inspection services for remedial projects*
- *Driller supervision*
- *Vertical and horizontal surveys*
- *Limited emergency response.*

As appropriate, these technicians assist our geologists and engineers in the field for complex, hydrogeological, geophysical, and contractor inspection tasks.



Storage Tank Management

Underground and aboveground storage tanks have recently come under greater public scrutiny and stricter regulation, and WW Engineering & Science has logged important experience in nearly all facets of effective storage tank management. Whether a particular project has involved the limited investigation of a single underground storage tank (UST), or the full design and implementation of underground to aboveground tank farm conversions, WWES has provided its clients with the following services:

- *UST Regulatory Compliance Assistance*
- *Geological and Hydrogeological Investigations*
- *Analytical Laboratory Testing*
- *Corrective and Remedial Action Plans*
- *Inventory Control Monitoring*
- *Engineering Design and Construction Management for New and Replacement Storage Tank Systems*
- *Volumetric Tank Testing*

We have assisted a broad range of industrial clients with storage tank management, including those in automotive manufacturing, pharmaceutical manufacturing, public utilities, and petroleum processing. Among many other projects, WW Engineering & Science has been selected by one of the major automotive manufacturers to manage the removal of 50 underground storage tanks located in six tank farm locations. We have also been retained by a major utility company to ensure that 26 UST facilities meet regulatory compliance requirements for state financial assurance, to manage necessary tank removals and replacements, and to perform follow-up corrective actions at certain sites. In yet another instance, our firm successfully designed and managed the construction of an eighteen-tank, aboveground storage tank facility to replace a major pharmaceutical manufacturer's existing underground tank farm. We also managed the removal of that underground system once the new facility was completed. These are just a few examples of our work in the area of storage tank management, but they illustrate our ability to handle complex projects in a coordinated and efficient manner.

Environmental Laboratory Services

Major corporations and governmental agencies alike have formally recognized the Environmental Laboratory Division of WW Engineering & Science as one of the leading analytical laboratories in the United States. For two of the past three years, the 3M Company of Minneapolis, Minnesota has awarded WW Engineering & Science top honors as the most outstanding of all its contract laboratories nationwide. The Michigan Department of Natural Resources (MDNR) recently awarded WW Engineering & Science a three-year, \$1.2-million contract to provide laboratory analysis for the State's Act 307 environmental cleanup program.



Our Environmental Laboratory Division is a full-service testing facility which plays an integral part in the comprehensive environmental consulting services we offer to industrial, governmental, professional, and commercial clients. Our laboratory provides a complete range of services, including:

- *Water, Wastewater, Soil, and Sludge Analyses*
- *Priority Pollutant Analyses*
- *NPDES, DSWA, RCRA Analytical Packages*
- *Solvent, Pesticide, and PCB Analyses*
- *Biological and Microbiological Testing*

Our laboratory's instrumentation, work experience, staff, and quality assurance procedures have earned it a solid reputation for quality and responsiveness.

Air Quality Services

WW Engineering & Science provides complete air quality services for industrial and governmental clients. Our Air Quality Services department is staffed by professionals experienced in testing, permitting, engineering, and licensing all types of facilities. Their experience includes:

Licensing and Regulatory Compliance Assistance

- *Permitting services for PSD, offsets, non-criteria pollutants, and all general industrial processes.*
- *BACT (Best Available Control Technology) and LAER (Lowest Achievable Emission Rate) demonstrations.*
- *Dispersion modeling for PSD, odors, toxics, and criteria pollutants.*
- *Compliance audits for permits and emission inventories.*
- *Environmental acceptability demonstrations for toxic air pollutants.*
- *Coating transfer efficiency demonstrations.*
- *Compliance negotiations for consent orders and permit conditions.*
- *Expert testimony.*

Stack Sampling and Ambient Air Monitoring

- *Compliance testing: Source emissions testing for criteria and non-criteria pollutants using state- and U.S. EPA-approved testing methods.*
- *Ambient monitoring: Sampling for criteria and non-criteria pollutants to meet permit requirements, preconstruction PSD, ground water, and hazardous waste cleanup operations, landfills, etc.*
- *Industrial hygiene studies: employee and workplace monitoring for OSHA compliance demonstrations, worker exposure levels, HVAC designs, etc.*



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- *Continuous emission monitoring (CEM) audits: performance evaluations for opacity, SO₂, NO_x, and other in-stack monitors.*
 - *Visible emissions evaluation: certified opacity observers to evaluate compliance with state and U.S. EPA opacity regulations.*



Representative Clients of WW Engineering & Science

Abitibi-Price
American Cyanamid
Amoco Oil
Amway
AT&T
Autostyle
Benteler Industries
B.F. Goodrich
Brunswick
ChemCentral Corporation
Coca Cola
Cooper Industries
CSX Transportation
Dean Foods
Dow Chemical USA
Dow Corning
ESCO
Ford Motor Co.
General Motors Corp.
Hexcel Chemical Products
Howmet Turbine Components
3M Company
Marathon
Mead Corp.
Meijer, Inc.
Michcon
Monsanto
Occidental Chemical
OXY-USA, Inc.
Quanex Corp.
Rexair
S.D. Warren
SPX
Sundstrand Corp.
Teledyne
The Upjohn Company
U.S. EPA Region V
Warner-Lambert
Welsh Oil Co.
White Consolidated Industries
Whirlpool Corporation



Hydrogeologic/Geophysical Services

REPRESENTATIVE EXPERIENCE HYDROGEOLOGIC/GEOPHYSICAL SERVICES

Following are brief descriptions of several environmental compliance projects completed by WW Engineering & Science. This is by no means a complete list of our hydrogeologic/geophysical projects, but it serves to indicate our experience and capabilities. It is important to keep in mind that our Hydrogeology/Geophysics Group is supported by our other in-house professional services including:

- ***Environmental Compliance***
 - ***Engineering (all disciplines)***
 - ***Laboratory Services***
 - ***Soil and Groundwater Remediation***
 - ***Storage Tank Management***
 - ***Construction Related Services.***
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- **Sitewide Hydrogeological Evaluation, Dow Chemical USA, Midland, Michigan**

The glacial stratigraphy was similar from location to location within the ***1,500-acre facility***. WWES assisted Dow to develop a site-wide understanding of the hydrogeology beneath the complex in order to effectively develop ground water resource management alternatives. First, WWES compiled stratigraphic information from ***3,800 previously installed wells and soil borings*** into a single database. This information, along with a synthesis of previous studies, allowed for assessment of ***Total Site Containment*** with respect to ground water. Further evaluation was accomplished by the development of a ***numerical flow model*** to simulate ground water flow under various naturally occurring or induced conditions. This enabled the design of effective control structures to prevent the flow. By properly monitoring these control systems, maintaining an updated database (currently including ***nearly 5,000 soil boring and well logs***), and maintaining an ***accurate ground water flow model***, effective ground water management is achieved in a cost-effective, proactive mode.

- **Hydrogeological Investigation, Remedial Action Program, and Ground Water Monitoring for Site Remediation, U.S. Aviax, Niles, Michigan**

The remedial action system, designed and constructed in 1983, included ground water purging and an air-stripping unit for removal of 99.99% of the volatile organic chemicals. In 1984, a ***Remedial Investigation and Feasibility Study*** was conducted to determine the nature and extent of off-site ground water contamination and a remedial action plan was developed. The study proposed both ***on-site source control*** and off-site ground water cleanup remedial actions.



- **Hydrogeologic Evaluation of a Gas Condensate Spill, Amoco Production Company, Kalkaska, Michigan**

WWES began a hydrogeologic investigation after the client discovered that pipeline leaks and other gas condensate spills had caused contaminants to infiltrate the ground water. WWES analyzed ground water samples from monitoring wells and soil samples (collected and analyzed on-site using a *portable gas chromatograph*) to determine the extent of the contamination. The results of this evaluation may be used to prepare a remedial action plan.

- **Hydrogeological Investigation, Grand Trunk Western Railroad Company, Battle Creek, Michigan**

Because of the proximity of the company's railroad yard to a major ground water contamination incident affecting the city of Battle Creek's water wells, the Michigan Department of Natural Resources and the U.S. EPA requested that the Railroad conduct a hydrogeological evaluation of one of its facilities. WWES conducted that evaluation and with it proved that the client's implicated facility had not contributed to the contamination problem affecting the city's well field. The *RI/FS Work Plan* prepared for the site is currently being negotiated with the U.S. EPA Region V as part of a consent order proceeding.

- **Hydrogeological/Geophysical Inspection, Western Michigan**

A *combined seismic and resistivity survey* was conducted in an effort to define the extent of *brine contamination* within a buried river channel. Several new techniques were employed during the seismic survey including the *Generalized Reciprocal Method*, an interpretation technique used to map the top of the till. During the large scale resistivity survey, a *Bison system* was used to collect resistivity sounding at locations throughout the study area.

- **Hydrogeological Investigation - Case Study, Michigan Department of Natural Resources, Comstock Township, Michigan**

The investigation was conducted to identify the sources of ground water *contamination affecting forty-three residential wells* in the Township. The project was part of the DNR's Ground Water Management Strategy and represented a case of known contamination with multiple suspected sources.

- **Geophysical and Hydrogeological Investigation, Mid-Michigan**

WWES conducted an *electromagnetic terrain conductivity survey* using a Geonic EM34-3 surface conductivity meter. The survey was performed to define the extent of a suspected *brine contamination* and to guide the placement of monitoring wells. The depth of brine migration into a confining clay layer was also mapped using the borehole geophysical logs.



- **Hydrogeologic Investigation of Ground Water Contamination on a Manufacturing Site, Northern Michigan**

WWES performed a hydrogeologic investigation to *define the aquifers and extent of contamination* beneath the plant site and in the immediate surrounding area. A Pollution Incident Prevention Plan was also prepared. Additionally, WWES participated in the negotiation of a *Consent Order* with the Michigan Department of Natural Resources for the installation of a ground water purge and treatment system.

- **Underground Thinner Tank Investigation, Syracuse, New York**

The investigation of contamination of soils and ground water around *underground solvent storage tanks* included the placement of monitoring wells and a purge well, the analysis of ground water and soil samples, participation in the negotiation of a consent order, and the submission of a final report with recommendations.

- **Remedial Action for Chemical Spill from Train Derailment, Chesapeake & Ohio Railway, Woodland Park, Michigan**

This project received the top national award for engineering excellence from American Consulting Engineers Council. Over *70,000 gallons of highly toxic organic compounds* were spilled in sandy soils with water table at depths of 40 to 50 feet. WWES was called in when initial cleanup work did not recapture all of the spilled substance. WWES then managed the *entire cleanup program* including determining the *extent of contamination*, managing the construction of ground water purging and treatment facilities, assessing environmental impacts, and coordinating efforts with regulatory agencies and local residents. The initial treatment system consisted of dual stage aeration ponds, followed by carbon adsorption and supplemented by spray irrigation. Carbon adsorption was eliminated when studies and monitoring showed that discharge standards could be met by spraying the effluent into an isolated wetland with outlet to a nearby lake. The purge/treatment system removed 99.9% of the chemicals. WWES continues to monitor ground water conditions to determine the need for any further remedial action.

- **Styrene Monomer Spill from Train Derailment, Chesapeake & Ohio Railway, Pearl, Michigan**

A remedial action designed and managed by WWES for a spill of *22,000 gallons of styrene monomer* included immediate excavation and skimming, construction of a *slurry wall* to contain the contaminated ground water and the development of an aeration treatment system that removed styrene from the ground water by a combination of volatilization and polymerization.

- **Remedial Action for Fluorosulfonic Acid Spill from a Train Derailment, Chesapeake & Ohio Railway, Bridgman, Michigan**

Emergency spill response services were provided when approximately *3200 gallons of fluorosulfonic acid* spilled forcing the evacuation of 1500 residents. The acid was



neutralized with 150 tons of lime. *Soil borings* determined that a 50-foot clay layer protected the aquifer. A clay pad was constructed to store the approximately 900 cubic yards of excavated materials. The site was backfilled and graded and the operation of the mainline track was restored within 29 hours of the derailment. The excavated materials were hauled to a nearby approved landfill in 11 gondola cars. An *environmental assessment* of the area was also conducted.

- **Remedial Investigation/Feasibility Study, and Construction, Teledyne Continental Motors, Muskegon, Michigan**

WWES conducted a *multi-phased hydrogeological investigation* to discover the impact, if any, on surrounding soils and ground water which may have been caused by old waste handling practices. The nature and extent of impacted ground water and soils were defined through construction of *test borings, observation wells, and the analysis of samples*. After approval of the recommendations for remedial action, a treatment system was designed and built by WWES. The system consists of six purge wells, two fresh water injection wells, an air stripping tower, and discharge to the Muskegon wastewater treatment facility.

- **Hydrogeologic Evaluation of a Pumping Station, Northern Michigan**

WWES conducted a hydrogeologic evaluation to determine the extent of ground water contamination due to hydrocarbon wastes. Important elements of this study included *in-situ permeability testing* of monitoring wells to estimate aquifer permeability and an *aquifer test* to determine aquifer *transmissivity*. This data was used to prepare an *analytical flow model* which guided the design and location of contaminant interceptor wells. A soil vapor survey helped to determine the horizontal extent of contamination. The vertical extent of contamination was determined by means of a carefully constructed test boring, which included numerous temporary wells for sample collection and the on-site analysis of those samples. WWES then prepared a *remedial action plan* that recommended the use of an AquaDetox air-stripper.

- **Hydrogeological Investigation and Remedial Action Program, Michigan**

The project involved a *three-phase hydrogeological investigation* of ground water contamination from *degreasing compounds*. A ten-well purge system was designed and constructed with purged ground water pumped to a central AquaDetox air-stripping system for treatment. The project also involved excavation and disposal of approximately 4,800 cubic yards of *contaminated soils*.

- **Preliminary Site Investigation of Former Coal Gas Manufacturing Plant Sites, Wisconsin Public Service Corporation, Green Bay, Oshkosh, Sheboygan, Two Rivers and Stevens Point, Wisconsin**

WWES managed and completed site investigations that included soil borings, monitoring well installation, sample collection, analytical testing, environmental evaluations, and recommendations for remedial action at *five former coal gasification sites in Wisconsin*.



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- **Hydrogeological Investigation, Remedial Action, and RI/FS Program, CHEMCENTRAL, Wyoming, Michigan**

A *hydrogeologic investigation* identified a ground water plume containing volatile organics and other chemicals. A ground water recovery system with purge wells and underdrain collection system and an AquaDetox treatment system were installed to decontaminate the ground water. PCB-contaminated soils were also excavated and disposed of. As a result of a consent order, an *RI/FS is being conducted*.

- **Hydrogeologic Investigation and Initial Water Quality Monitoring, Walloon Lake Association, Charlevoix and Emmet Counties, Michigan**

The purpose of this project was to investigate the *geologic, hydrologic, biological, and chemical characteristics of the Walloon Lake watershed* and to make recommendations for the establishment of a water quality monitoring program.

- **Hydrogeological Investigation of a Landfill, James River Corporation, Kalamazoo, Michigan**

The purpose of the study was to define the hydrogeologic characteristics of the *112-acre landfill* and to determine what effect the disposal of solid wastes had on ground water quality. In addition, the study was to determine whether the landfill could be licensed under *Act 641*, what classification it would receive for disposal of waste-paper and dewatered paper sludge, and what steps were needed for closure if it could not satisfy the requirements.

- **Hazardous Waste Landfill Permit Application (Michigan Act 64), Dow Chemical USA, Midland, Michigan**

The project involved a *hydrogeologic study, landfill design, environmental assessment, failure mode assessment, spill and accident prevention plan and contingency plan, and emergency procedures*. This is still the only application for a new hazardous waste landfill approved in Michigan.

- **Hydrogeological Investigation of the Effect of Wastewater Spray Irrigation, Welch Foods, Inc., Lawton, Michigan**

Phase I involved determining background and existing water quality, *identifying area aquifers*, defining the nature of the water table, determining the direction of ground water movement, and identifying reduced infiltration capabilities caused by effluent irrigation. Phase II involved implementing engineering options for modifications and improvements. In addition, WWES established a ground water monitoring program.

- **Soils Investigation of Waste Storage Sites, Hooker Chemical Company, Montague, Michigan**

A soils investigation was conducted to selectively *sample the soils* in and near the waste storage sites of a major chemical manufacturer. Using *highly sophisticated sampling procedures*, soils suspected of contamination were carefully collected and



stored. Samples were frozen and stored in special inert containers. The work program included soil borings and split spoon cores from twenty-five sample points.

- **Site Investigation for ECRA Closure, Nutley, New Jersey**

In preparation for the sale of one of its facilities, the client contracted WWES to investigate whether their site and facilities met state cleanup standards. The investigation included a detailed sampling plan of various manufacturing and storage areas, a *geophysical survey* of the 23-acre plant site, the installation of *ground water monitoring wells*, and the collection of soil samples at various locations.

- **Hydrogeologic Evaluation of Brine in Ground Water, Northern Michigan**

Upon request of the Michigan Department of Natural Resources, WWES conducted a hydrogeologic evaluation of this chemical manufacturing facility to determine ground water and soil quality, subsequently estimating the quantity of brine migrating off-site to an adjacent lake. Initially, a *surface geophysical survey* was performed using electromagnetics and resistivity. Deep exploration borings were constructed based on the survey results and geological information was refined to identify the vertical position of brine plumes. Monitoring wells were constructed and ground water samples were collected for analysis.

- **Investigation of the Impact on a Stream's Water Quality and Sediments, Michigan Consolidated Gas Company, Greenville, Michigan**

The initial investigation of a *former coal gas manufacturing plant* led to a more detailed study of the impact of soil and ground water contaminants flowing from the site into a nearby stream. The subsequent detailed hydrogeological investigation included measuring contaminant concentrations in the ground water and in the stream's water and sediments both upgradient and downgradient of the site; determining any environmental effects from the contaminants on the stream's sediments and water quality, including effects from dilution and natural processes; and defining the extent and nature of any coal tar deposits found on-site.

- **Michigan - EPA Superfund Remedial Investigation, Livingston County, Michigan**

The objectives were to investigate and obtain sufficient hydrogeological information on the site and the nearby surroundings to develop an effective remedial action. Tasks included managing the *hydrogeological investigation* and developing detailed information on the *soils* and their continuity within the upper and lower aquifer to *depths of 200 feet and more*; describing the *plumes of contamination* within the aquifers; and preparing an environmental assessment describing existing conditions and impacts of hazardous wastes upon vegetation and animal life.



- **Contaminated Ground Water Cleanup Using Purge Wells and an Air Stripping Tower, Brunswick Corporation, Muskegon, Michigan**

This project involved an *extensive hydrogeological investigation* to define the vertical and lateral extent of ground water contaminated with toluene. WWES remediated the site by installing two ground water purge wells and an air stripping tower for treatment of the ground water. The effluent discharges to a storm sewer.

- **Comprehensive Hydrogeological Investigation, Madison Gas and Electric Company, Madison, Wisconsin**

The investigation at a former coal gasification site involved soil borings, well installations, sample collection, *in-situ permeability measurements*, analytical testing, environmental evaluation, and *human health risk assessment*.

- **Investigation of a Brine Spill, Dow Chemical Company, Midland, Michigan**

WWES investigated the effects of an accidental spillage and subsequent runoff of dilute brine in order to estimate the potential for reduction in crop yield, the priority areas for removal of pooled runoff, and the amount of brine in the soils within the runoff areas. *Hundreds of soil samples* were prepared and analyzed, testing saturated extracts of soils for specific conductance using a portable instrument with a micro-probe capable of analyzing less than one milliliter of water.

- **Hydrogeological Investigation and Remedial Action Program, Rockford, Illinois**

A contamination problem involving toluene was discovered in the ground water. A hydrogeological investigation identified the source to be a *leaking spill containment sump*. Based upon *analytical modeling* and a ground water *pumping test*, a two-well purge system was designed and constructed for capturing the contaminated ground water. The water is then treated by an air stripping system and discharged, mostly, directly to the municipal sanitary sewer. A small portion of the treated water is discharged back into the source area unsaturated soils for flushing. A second phase evaluation dealt with contamination involving chlorinated solvents. Additional monitoring wells were constructed and sampling performed; ground water flow modeling and aquifer testing provided an estimate of the effectiveness of an additional purge well. A third purge well was installed and the discharge piped to the existing air stripper. A long-term ground water sampling and analysis program monitors the continued effectiveness of the purge well and treatment system.



Remedial Investigations/Feasibility Studies

REPRESENTATIVE EXPERIENCE
REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES
(RI/FS)

Following are brief descriptions of several RI/FS projects completed by WW Engineering & Science. This is by no means a complete list of our projects in this area, but it serves to indicate our experience and capabilities.

Groundwater Reclamation

WW Engineering & Science has successfully completed many ground water reclamation projects involving 15 to over 1,500 gallons per minute of contaminated ground water. Although biological treatment has not typically been the selected treatment for these systems (because almost all involve high concentrations of chlorinated compounds) they serve to illustrate the ability of WWES to investigate, model, design, construct, and operate successful ground water capture systems.

- **In situ Bioremediation Pilot Study, West Michigan**

An extensive bench-scale pilot study was successfully performed to confirm the effectiveness of enhanced aerobic in situ bioremediation for cleanup of ground water and soils in the area of a former underground storage tank farm. The study involved batch microcosm tests to evaluate nutrient requirements and the effectiveness of hydrogen peroxide as an oxygen source, a flow-through study to more closely reflect actual field conditions, and monitoring of samples of the recirculated ground water for the degradation of the organic material. The study results indicated that indigenous microorganisms present in the subsurface would successfully degrade the organic constituents to concentrations near the detection limit, and that hydrogen peroxide would be an effective source of oxygen. Design of the full-scale in situ bioremediation system is currently underway.

- **Ground Water Treatment System, Northern Michigan**

The groundwater beneath this chemical manufacturer's facility was contaminated with benzene, toluene, and ethyl benzene, as well as other aliphatic hydrocarbons. A hydrogeological investigation determined that 300 gpm of ground water had to be purged to remediate the site. A treatment system was installed to treat the purged ground water. A free product recovery system was installed. Effluent with no detectable concentration is reinjected to manage the contaminated plume. This project has received national attention and visitation from interested parties and agencies.



- **Ground Water Treatability/Pilot Project**

This project was recently completed for a major chemical company site in the southern United States. Another consultant had developed a purge well system and the water was being treated by a very inefficient, trayed steam stripper. Our semi-trailer-mounted mobile organics separations unit was deployed on site to evaluate steam stripping under partial vacuum and at atmospheric conditions on a side stream of purge ground water. When free distillate oils began appearing in the influent, with some process adjustments, we proved that atmospheric steam stripping was the preferred mode of operation and that the process would achieve the desired effluent concentrations at vapor rates of less than 60 percent of their current process. We have now designed a 1000 gpm full-scale unit which includes oil removal and inorganic water conditioning processes.

- **Contaminated Ground Water Cleanup Using Purge Wells and an Air Stripping Tower, Brunswick Corporation, Muskegon, Michigan**

After an extensive hydrogeological investigation to define the extent of ground water contaminated with toluene, WWES remediated the site by installing two ground water purge wells and a treatment system consisting of a 4-foot diameter air stripping tower with 30 feet of packed media. A ground monitoring program is currently in effect.

- **Act 64 Permit Application, Dow Chemical USA, Midland, Michigan**

WWES prepared the original Michigan Act 64 construction permit application for the Salzburg Landfill, which included a detailed hydrogeological investigation, environmental assessment, landfill design, failure mode assessment, spill and accident prevention plan and contingency plan, and emergency procedures. This site is still the only hazardous waste landfill in Michigan approved by the Act 64 siting board. In more recent years, WWES has prepared the groundwater monitoring portion of RCRA Part B applications for the Salzburg Landfill and Dow's other land disposal and storage facilities in Midland.

- **Surface Impoundment Closure/Capping, Southern Michigan**

WWES was retained to perform extensive, detailed studies which included sludge sampling, chemical and physical properties analysis, berm integrity studies, sludge stabilization, bench tests, hydrogeological evaluations, ground water monitoring and evaluation of remedial alternatives. WWES also assisted in the negotiations with the Michigan Department of Natural Resources and the U.S. EPA.

In 1989, WWES completed the environmentally sound closure of the five year non-hazardous impoundment which contained alum muds with trace concentrations of the organic chemicals formaldehyde, toluene, and acrylamide. The impoundment closure construction was conducted in two phases. During Phase I, the alum spoils pile was cleared, temporary haul roads were provided, excavated alum spoils were used to fill



the impoundments to preliminary grades, temporary drainage and erosion control were provided, and the alum spoils were regraded.

Phase II included placement of an engineered cap on the fill materials including: finish grading, seeding, and mulching the alum spoils pile; finish grading the impoundments to primary grades, adding kiln dust as required to provide additional structural stability to the alum muds; installing a synthetic membrane over the impoundments; placing 8" clay over the membrane, placing and grading a 4" layer of topsoil over the clay layer and seeding and mulching the area; constructing a drainage system; and restoring the site.

- **Remediation of Soils and Impacted Groundwater, Autostyle Plastics, Grand Rapids, Michigan**

The project involved soils and ground water impacted by acetone, toluene, methyl ethyl ketone, and isopropanol. Remediation included the installation of a soil vapor extraction system with incineration of air emissions. Ground water is collected with three sumps and one interceptor trend and is treated with a 30 gpm submerged fixed-film biological treatment system. Effluent is discharged to the municipal waste water collection and treatment system. Air emissions are controlled with the same incinerator serving the soil vapor extraction system. Extensive hydrogeological work was performed prior to design of the remediation system to delineate the extent of the ground water containment plume.

- **Site Remediation, Rexair, Inc., Cadillac, Michigan**

Due to an "emergency threat" to a nearby city well field, WWES was retained to quickly design and construct a permanent system to treat potentially 1,500 gpm of TCE contaminated ground water. A 600 gpm, three-well system was initially constructed to collect contaminated ground water closest to the city well field. The water was brought to a two-tower stripping system with carbon vapor adsorption emission controls. Effluent is discharged through approximately 4,500 feet of pipe to a surface water discharge. A soil vapor extraction system will be added to extract TCE from the source area. Approximately 300 gpm of the treated effluent will be used by the plant as non-contact cooling water.

- **Hydrogeological Investigation and Remedial Action Program, Michigan**

The project involved a three-phase hydrogeological investigation of ground water contamination from degreasing compounds. A ten-well purge system was designed and constructed with purged groundwater pumped to a central 1,500 gpm system for treatment. The project also involved excavation and disposal of approximately 4,800 cubic yards of contaminated soils.



- **Milan Landfill Closure, Rumpke of Indiana, Inc., Milan, Indiana**

WWES prepared the Milan Landfill complete closure and post-closure plan application package necessary to fulfill the State of Indiana, Department of Environmental Management rules and regulations. A quality control/quality assurance program was provided to assure the facility was closed and monitored properly. Cost estimates were also prepared for financial bonding purposes.

- **Remedial Investigation and Feasibility Study at the Tri-County Landfill, U.S. Environmental Protection Agency, South Elgin, Illinois**

In May 1986, the Tri-County Landfill was proposed to be added to the U.S. Environmental Protection Agency National Priorities List. The U.S. EPA has authorized WW Engineering & Science to conduct a Remedial Investigation and Feasibility Study (RI/FS) of the Tri-County Landfill site. The Illinois EPA performed technical review and project oversight responsibilities in conjunction with the U.S. EPA. The Tri-County Landfill is an inactive solid waste landfill located east of the Village of South Elgin, Illinois.

In conducting its Remedial Investigation, WWES will assess and evaluate the potential extent and magnitude of on-site and off-site contamination at the Tri-County site. Based on the results of the RI, a Feasibility Study will be completed to recommend cost-effective, technically viable remedial alternatives for mitigating the hazard posed by the contamination. Field work began in March 1989 and the final FS report is scheduled to be completed by September 1991.

- **Remedial Investigation and Feasibility Study for the Skinner Landfill, U.S. Environmental Protection Agency, West Chester, Ohio**

In December 1982 the Skinner Landfill was placed on the U.S. EPA's National Priorities List (NPL) of contaminated sites. The Skinner site was originally a sand and gravel operation and first became involved in landfill operations in 1934 with the disposal of general municipal refuse in abandoned sand and gravel pits. A former lagoon area at the site has allegedly been used for disposal of industrial chemical waste. In January 1990, WW Engineering and science began a comprehensive Remedial Investigation and Feasibility Study at the 780-acre site which is currently licensed to accept demolition debris. In its RI, WWES will assess the extent, magnitude, and migration of potential ground water, soil, and surface water contamination. WWES will also assess the potential risks to human health and the environment that the site poses. Based on the results of the RI, a FS will be completed and will result in recommended, cost-effective, technically sound remedial alternatives for mitigating any hazards posed by the site.



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- **RCRA Ground Water Monitoring System, Hydrogeologic Investigation, Part B Permit Application (Hydrogeology Volume), EnviroSafe Services of Ohio, Inc., Oregon, Ohio.**

A comprehensive hydrogeologic study was conducted and the hydrogeologic portions of the Part B permit application authorized for the ESOI Otter Creek and Wynn Road facilities. The Otter Creek facility is the largest commercial secure (hazardous waste) landfill in the state of Ohio. The project included the design and installation of a CFR 40 Part 264 RCRA ground water monitoring system.

- **Hydrogeologic Site Assessment and Remediation Investigation of a Solid Waste Landfill, Laidlaw Waste Systems, Inc., Adrian, Michigan**

A hydrogeologic site assessment was conducted as part of the closure of the existing site. Initial phases of the investigation involved design and installation of a ground water monitoring system, performance and evaluation of aquifer tests, installation of leachate test wells, and compilation of a comprehensive hydrogeologic report. Subsequent phases of the study entailed a remediation investigation which included defining the vertical and lateral extent of contamination using a portable gas chromatograph for the detection/identification of Volatile Organic Compounds in ground water samples, design and computer modeling of remediation measures, and correspondence and negotiations with state regulators. A remediation system consisting of 17 purge wells was subsequently installed and tested. The effectiveness of the system is currently being monitored through quarterly performance evaluations. A geotechnical evaluation of a proposed new disposal area was also conducted.

- **Hydrogeologic and Remedial Investigation at a Closed Solid Waste Site, Browning-Ferris Industries, Oakland County, Michigan**

A comprehensive hydrogeologic and remedial investigation was completed at a closed solid waste landfill which was being considered for purchase by the client. The purposes of the investigation were to further characterize the site hydrogeology and to define the horizontal and lateral extent of existing ground water contamination. Initial phases of the study included geophysical investigation (resistivity) and soil gas surveys. Soil gas samples were collected and analyzed in the field with a portable gas chromatograph. Brings and wells were located based on the results of the geophysical and soil gas survey to provide ground water quality data points and stratigraphic information. Water samples were collected from all existing monitoring wells and were analyzed in the field with the portable gas chromatograph for the detection of volatile organic compounds. Computer and analytical modeling was performed to evaluate potential remedial designs. The entire field investigation and preparation of a comprehensive report were completed in less than three months.



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- **Hydrogeologic Site Assessment of a Solid Waste Landfill, Envirite Corporation, Wyandotte County, Ohio.**

A hydrogeologic site evaluation was conducted as a portion of the Permit to Install for closure of the present landfill and expansion of the facility. A geotechnical evaluation of the expansion area was performed which included logging of numerous soil borings, construction of detailed geologic cross sections, and installation and testing of piezometers. An angle (45°) piezometer was installed and tested to evaluate the influence of fractures on the hydraulic conductivity of till deposits. A ground water isotopic study was completed which utilized tritium to gain information on recharge rates. A comprehensive hydrogeologic report was prepared and submitted to the Ohio EPA, Northwest District Office. Proposals for the installation of a ground water monitoring system have also been submitted.

- **Hydrogeologic Site Assessment of a Solid Waste Landfill, Laidlaw Waste Systems, Inc., Celina, Ohio**

A hydrogeologic site investigation was conducted and hydrogeologic report submitted to the Ohio EPA, Northwest District Office. The investigation included logging of numerous soil borings, installation of nine monitor wells, performance and analysis of aquifer tests, construction of geologic cross sections, water quality sampling and data evaluation, isotopic analysis of ground water samples for tritium content to gain information on recharge rates, and installation of methane monitor probes.

- **Closure Design and Remedial Action Plan for a Type II Landfill, City of Mackinac Island, Michigan**

Faced with a Consent Order from the Michigan Department of Natural Resources (MDNR), the City of Mackinac Island retained WW Engineering & Science to design and manage the closure of its 15-acre Type II landfill, and to prepare a plan for remediation of moderate ground water contamination at the landfill. The landfill cap, as designed by WWES in accordance with Michigan Act 641 standards, incorporates a VLDPE (Very Low Density Polyethylene) liner and composed municipal solid waste as cover. WWES also developed a closure and post-closure plan which includes ground water monitoring. In addressing the need for remediation at the site, WWES assisted the City of Mackinaw Island in negotiating with the MDNR for a deadline extension to the Consent Order. The City was unable to secure the financing it needed to complete the project within the allotted time. WWES also developed an eight-step remedial action strategy and, pending further hydrogeological investigation, will develop site specific risk-based cleanup standards pursuant to a "Type C" remedial action plan as outlined in Michigan's newly approved Act 307 rules.



Soil & Groundwater Remediation Services

REPRESENTATIVE EXPERIENCE

SOIL AND GROUND WATER REMEDIATION SERVICES

Following are brief descriptions of several soil and ground water remediation projects completed by WW Engineering & Science. This is by no means a complete list of our remediation-related projects, but it serves to indicate our experience and capabilities. It is important to keep in mind that our Remedial Technologies Group is supported by our other in-house professional services including:

- *hydrogeology/geophysics*
- *engineering (all disciplines)*
- *laboratory services*
- *environmental compliance*
- *construction related services.*

Beginning with any phase of a project's life, we have the capability to take that project to completion.

- **Remedial Action for Fluorosulfonic Acid Spill from a Train Derailment, Chesapeake & Ohio Railway, Bridgman, Michigan**

Emergency spill response services were provided when approximately **3200 gallons of fluorosulfonic acid** spilled forcing the evacuation of 1500 residents. The acid was neutralized with 150 tons of lime. Soil borings determined that a 50-foot clay layer protected the aquifer. A clay pad was constructed to store the approximately **900 cubic yards of excavated materials**. The site was backfilled and graded and the operation of the mainline track was **restored within 29 hours of the derailment**. The excavated materials were hauled to a nearby approved landfill in 11 gondola cars. An environmental assessment of the area was also conducted.

- **Emergency Spill Response for Train Detailments, Chesapeake & Ohio Railway, Norton Shores and St. Joseph, Michigan**

In Norton Shores, WWES provided *emergency spill response services* when approximately 200 gallons of **sodium hydroxide** spilled. The material was contained, neutralized, and then disposed with the contaminated soil at a local landfill. In St. Joseph, three of the six railroad cars containing **ethyl benzene** had slow leaks. The chemicals were contained, captured, and transferred to 55-gallon drums for return to the chemical manufacturer for disposal. Soil did not have to be excavated.



- **Ground Water Investigation of Gasoline Spill Contamination, Michigan Department of Natural Resources, Grand Rapids, Michigan**

The MDNR contracted with WWES for the investigation of a *gasoline spill* from underground storage and the *assessment of alternatives* for the removal and treatment of the aromatic and other volatile components of gasoline from the ground water.

- **In Situ Bioremediation Pilot Study, West Michigan**

An extensive bench-scale pilot study was successfully performed to confirm the effectiveness of *enhanced aerobic in situ bioremediation* for cleanup of ground water and soils in the area of a former underground storage tank farm. The study involved batch microcosm tests to evaluate nutrient requirements and the effectiveness of hydrogen peroxide as an oxygen source, a *flow-through study* to more closely reflect actual field conditions, and monitoring of samples of the recirculated ground water for the degradation of the organic material. The study results indicated that *indigenous microorganisms* present in the subsurface could successfully degrade the organic constituents to concentrations near the detection limit, and that *hydrogen peroxide* would be an effective source of oxygen. Design of the *full-scale in situ bioremediation system* is currently underway.

- **Gasoline Spill Cleanup, Wesco Station, Lowell, Michigan**

A hydrogeological evaluation of a *15,000-gallon gasoline spill* and the design of a gasoline recovery system was undertaken by WWES.

- **Aviation Fuel Spill Remediation, Woodward Governor, Rockford, Illinois**

WWES performed a *soil vapor survey*, constructed monitoring wells, and collected water samples to identify the extent of contamination. Remediation of the aquifer included construction of *multiple large diameter sumps, free product recovery, treatment* of the water with an air stripping tower and discharge of the water to the Sanitary District. The *pilot study* utilized WWES's portable air stripping tower.

- **Ground Water Treatment System, Northern Michigan**

The ground water beneath this chemical manufacturer's facility was contaminated with *Benzene, Toluene and Ethylbenzene*, as well as other aliphatic hydrocarbons. A hydrogeological investigation determined that 300 gpm of ground water must be purged to remediate the site. A *two-tower air stripping system* was installed to treat the purged ground water. Air emissions from the first tower were treated using *catalytic incineration* and from the second tower were discharged to the atmosphere.



- **Hydrogeological Investigation, Grand Trunk Western Railroad Company, Battle Creek, Michigan**

A hydrogeologic investigation was requested of the client by the Michigan Department of Natural Resources and the U.S. EPA because of the proximity to a major ground water contamination incident affecting the city's water wells. The investigation proved that the facility did not contribute to the contamination problem. WWES also prepared a *Remedial Investigation and Feasibility Study Work Plan* for the railroad yard and an adjacent investigation area.

- **Hydrogeological Investigation and Remedial Action Program, Michigan**

The project involved a three-phase hydrogeological investigation of ground water contamination from degreasing compounds. A *ten-well purge system* was designed and constructed with purged ground water pumped to a central *AquaDetox air-stripping system* for treatment. The project also involved excavation and disposal of approximately *4,800 cubic yards of contaminated soils*.

- **Coal Gasification Site Investigation, Riverside Park - Station "A", Michigan Consolidated Gas Company, Detroit, Michigan**

Initial investigations indicated presence of hazardous wastes at a former coal gasification site converted into a city park. WWES completed site investigation, sample collection, analytical testing, environmental evaluation, and presented a report documenting these activities and recommending appropriate remedial action. Remedial actions included the *isolation of near-surface soils* using a synthetic membrane and cover soils, the *removal of coal tar saturated soils*, and the construction of an *interceptor ditch*, underground sprinkling system and landscaping.

- **Management of Cleanup of Chemical Spill from Train Derailment, Chesapeake & Ohio Railway, Silverwood, Michigan**

WWES managed a remedial action program to clean up contaminated soils and surface water resulting from a spill of *10,000 gallons of hydrochloric acid*. Approximately 60 cubic yards of contaminated soils were excavated and disposed of at an approved landfill.

- **Contaminated Ground Water Cleanup Using Purge Wells and an Air Stripping Tower, Brunswick Corporation, Muskegon, Michigan**

After an extensive hydrogeological investigation to define the extent of ground water contaminated with toluene, WWES remediated the site by installing *two ground water purge wells* and a treatment system consisting of a 5 foot-diameter air stripping tower with 30 feet of packed media. A ground water monitoring program is currently in effect.



- **Hydrogeological Investigation, Remedial Action, and RI/FS Program, CHEMCENTRAL, Wyoming, Michigan**

A hydrogeologic investigation identified a ground water plume containing volatile organics and other chemicals. A ground water recovery system with purge wells and underdrain collection system and an AquaDetox treatment system were installed to decontaminate the ground water. *PCB-contaminated soils* were also excavated and disposed of. As a result of a consent order, an RI/FS is being conducted.

- **Train Derailment Spill Response and Cleanup, CSX Transportation, Zaleski, Ohio**

WWES was contacted to manage the cleanup after 24 railway cars derailed releasing approximately 18,000 gallons of methylene chloride. Investigation indicated that the released material was confined to the immediate spill zone. WWES then designed a continuous flow purge well and air stripping tower system for ground water treatment. Following the cleanup period, the area was filled in, regraded, covered with clay soils and seeded. During these activities, WWES established an on-site mobile analytical laboratory.

- **Hydrogeologic Evaluation of a Gas Condensate Spill, Amoco Production Company, Kalkaska, Michigan**

A hydrogeologic evaluation, along with soil and water analyses, was undertaken to define the extent of ground water contamination from a gas condensate spill and to provide information for the preparation of a remedial action plan.

- **Preliminary Site Investigation of Former Coal Gas Manufacturing Plant Sites, Wisconsin Public Services Corporation, Green Bay, Sheboygan, Oshkosh, Stevens Point, and Two Rivers, Wisconsin**

WWES managed and completed site investigations that included soil borings, monitoring well installation, sample collection, analytical testing, environmental evaluations, and recommendations for remedial action at five former coal gasification sites in Wisconsin.

- **Development of Compliance Strategy for Spent Pickle Liquor Surface Impoundments and Sludge Drying Beds, Quanex Corporation - Michigan Seamless Tube Division, South Lyon, Michigan**

The project involved the RCRA closure and monitoring of two surface impoundments containing spent pickle liquor from steel finishing operations and the design of a wastewater treatment system to replace the leaking surface impoundments.



- **Closure of Underground Gasoline Storage Tanks, GMC, Buick-Oldsmobile-Cadillac, Flint, Michigan**

WWES managed and directed the closure of five underground tanks which previously had been used to store flammable liquids. WWES performed on-site monitoring, inspection, analytical testing, and final report preparation in these closure activities.

- **Hydrogeological Investigation and Remedial Action Program, Rockford, Illinois**

The project involved evaluating a hydrogeological report, performing additional hydrogeological investigations, finalizing a remedial action concept, and designing and implementing this plan. This involved design and construction of two purge wells and a 40 gpm AquaDetox air-stripping tower for cleanup of toluene contaminated ground water.

- **Kentwood Landfill RI/FS Work Plan Preparation, Kent County and City of Kentwood Departments of Public Works, Kentwood, Michigan**

WWES prepared a detailed work plan to conduct an EPA-required Remedial Investigation (RI) and Feasibility Study (FS) under CERCLA at the closed landfill.

- **Preliminary Site Investigation, Former Coal Gas Manufacturing Plant, Northern States Power Company, Eau Claire, Wisconsin**

WWES completed soil borings, well installation, sample collection, analytical testing, environmental evaluation, and subsequently, recommended remedial action at the former coal gasification site.

- **Ongoing Environmental Services, Calhoun County Road Commission, Marshall, Battle Creek and Albion, Michigan Facilities**

WWES has worked extensively with the Road Commission since 1987 to investigate and remedy environmental problems associated with the above listed facilities. WWES has prepared, implemented and completed hydrogeological investigations, feasibility studies and corrective action plans. Corrective Action included removal, closure and installation of new UST's and fuel dispensing stations; removal of dry wells and disposal of impacted soils; construction of secondary containment structures for oils and critical materials; and evaluation, design and construction supervision of wastewater collection systems at each facility.

- **Evaluation of Feasible Alternatives for Handling and Disposal of Sludge Materials Stored in a Surface Impoundment, BASF Corporation Chemicals Division, Wyandotte, Michigan**

The study's purpose was to develop appropriate disposal techniques for a large volume of sludge stored in a wastewater surface impoundment. Sludge depth



measurements and samples were collected and analyzed. Analysis did not indicate that the sludge was hazardous. Alternatives for removal, handling and disposal were investigated and the decision was made to discharge impoundment clear water to the Detroit River, pump out and dewater slurry on-site or off-site, and dispose of sludge cake at a Type II landfill.

- **Site Remediation, Rexair, Inc., Cadillac, Michigan**

Due to an "emergency threat" to a nearby city well field, WWES was retained to quickly design and construct a permanent system to treat potentially 1500 GPM of TCE contaminated ground water. A 600 gpm, three-well system was constructed to collect contaminated ground water closest to the city well field. The water was brought to a two tower air stripping system with carbon vapor adsorption emission controls. Effluent is discharged through approximately 4,500 feet of pipe to a surface water discharge. A soil vapor extraction system will be added to extract TCE from the source area. Approximately 300 gpm of the treated effluent will be used by the plant as non-contact cooling water.

- **Hydrogeological Investigation, Remedial Action Program, and Ground Water Monitoring for Site Remediation, U.S. Aviax, Niles, Michigan**

The remedial action system, designed and constructed in 1983, included ground water purging and an air-stripping unit for removal of 99.99% of the volatile organic chemicals. In 1984, a Remedial Investigation and Feasibility Study was conducted to determine the nature and extent of off-site ground water contamination and a remedial action plan was developed. The study proposed both on-site source control and off-site ground water cleanup remedial actions.

- **1989-90 UST Removals/Replacement, BOC-Flint Automotive Division**

WWES will remove and replace 50 UST's at 6 tank farm locations with above ground tank farms over the two year period. Services to be provided include safety plan, work plan, construction management, project supervision, all field testing and analytical work, and review of new facility construction documents. In addition, WWES is responsible for closure assessments and initial remediation planning or investigation.

- **Environmental Site Assessment and Remediation at a Manufacturing Building, West Michigan**

The assessment was requested by the owner to identify potential environmental problems resulting from the leasing of the facility. Several stained areas were identified. Soil sampling and analysis documented the condition of the areas of concern. Since the tenant handled hazardous materials, WWES recommended remediation measures for the final cleanup of any contaminated areas and the proper disposal of waste materials and excavated soils.



- **Environmental Site Assessment and Hydrogeological Investigation for an Automotive Stamping Firm, Lansing, Michigan**

The assessment, required for pending plant expansion, involved inspection, owner and former employee interviews and review of regulatory files. Limited borings and wells revealed soils and perched ground water impacted with PCE and chlorobenzene, compounds never used by the present firm. The main phase of the investigation involved 25 hollow-stem auger borings and split-spoon samples, seven temporary wells and two permanent monitor wells, and sampling of sediments from storm sewer catch basins. The next phase will involve an environmental risk assessment and work plan for remediation.

- **Soil Remediation, Abitibi-Price Corporation, Alpena, Michigan**

To eliminate a future ground water remediation project, contaminated soils from the source areas were excavated and disposed. Because the nearest licensed disposal facility was over 100 miles away, a Photovac 10S55 Portable Gas Chromatograph was used on-site to ensure that the most impacted soils were removed reducing overall project costs. In a two week period landfill coordination was completed, 5,440 cubic yards of soils disposed, and the area backfilled and restored.

- **Remediation of Soils and Impacted Ground Water, Autostyle Plastics, Grand Rapids, Michigan**

The project involved soils and ground water impacted by acetone, toluene, methyl ethyl ketone, and isopropanol. Remediation included the installation of a soil vapor extraction system with incineration of air emissions. Ground water is collected with three sumps and one interceptor trench and is treated with a 15 gpm submerged fixed-film biological treatment system. Effluent is discharged to the municipal wastewater collection and treatment system. Air emissions are controlled with the same incinerator serving the soil vapor extraction system. Extensive hydrogeological work was performed prior to design of the remediation system to delineate the extent of the ground water containment plume.

- **Remedial Action for Chemical Spill from Train Derailment, Chesapeake & Ohio Railway, Woodland Park, Michigan**

This project received the top national award for engineering excellence from American Consulting Engineers Council. Over 70,000 gallons of highly toxic organic compounds were spilled in sandy soils with water table at depths of 40 to 50 feet. WWES was called in when initial cleanup work did not recapture all of the spilled substance. WWES then managed the entire cleanup program including determining the extent of contamination, managing the construction of ground water purging and treatment facilities, assessing environmental impacts, and coordinating efforts with regulatory agencies and local residents. The initial treatment system consisted of dual stage aeration ponds, followed by carbon adsorption and supplemented by spray irrigation. Carbon adsorption was eliminated when studies



and monitoring showed that discharge standards could be met by spraying the effluent into an isolated wetland with outlet to a nearby lake. The purge/treatment system removed 99.9% of the chemicals. WWES continues to monitor ground water conditions to determine the need for any further remedial action.

- **Remedial Investigation and Site Cleanup, Indiana Department of Environmental Management, Kokomo, Indiana**

WWES was contracted to investigate and clean up pickle liquor contamination at the former Continental Steel site. The extent of liquid and solid waste contamination was determined qualitatively and quantitatively. WWES prepared to decant the liquid held in the SO4 lagoon to levels amenable to final closure, worked with IDEM to evaluate final closure alternatives, and prepared closure recommendations. A stabilization study has now been done to immobilize the metals contained in the sludge and soils.

- **Remedial Strategy and Proposed Remedial Action, Dowagiac, Michigan**

WWES prepared remedial strategy to address widespread contamination of soils with metals and semi-volatile organics at an industrial site. The relative immobility of metals was demonstrated through laboratory testing. The proposed remedial action includes excavation and stabilization of hotspots, and capping of entire exposed area.

- **Characterization and Stabilization of Sludge and Soils, Zeeland, Michigan**

WWES characterized sludge and soils in an industrial wastewater holding pond operated by an organic chemicals manufacturer. The sludge, known to contain various organics and metals, was demonstrated to be characteristically nonhazardous. It was subsequently stabilized and transported, along with impacted soils, for landfill disposal.

- **Spent Pickle Liquor Treatment and Discharge, Steel Industry, Kokomo, Indiana**

Approximately six million gallons of spent pickle liquor from an abandoned steel processing plant were stored in a clay-lined surface impoundment. The liquor was a sulfuric acid solution and had a pH of 1.8. Dissolved metals represented a threat to the ground water. Samples of the spent pickle liquor were collected for analysis and treatability testing. Test results were used in arranging permitted discharge of the treated pickle liquor to the City of Kokomo wastewater treatment system via a public sewer. City Industrial Pretreatment Plan limits were to be met which required treatment of the acid. WWES set up a temporary treatment system on-site to neutralize the liquor using quick lime which was slurried on-site. Treated water passed through a final settling tank from which a portion was pumped to the sewer and the remainder was recirculated to the impoundment until target pH levels were achieved. A passive neutralization bed will be installed with an intermittently-operated collection sump. This will continue to dewater nearby accumulated sludge



piles and remove precipitation as it collects on-site until the wastes are stabilized in place and the entire site capped with a protective cover.

- **Cleanup of Abandoned CERCLA (Superfund) Disposal Site Containing Metal-Finishing Wastewater Treatment Sludges, Burrows Group, Hartford, Michigan**

WWES managed and directed the site's remedial action program within the program. The management team developed a health and safety plan, prepared contract documents for soil and sludge excavation and disposal, provided on-site management of sub-contractor activities, provided all necessary scheduling, budgeting, staffing, cost control, and site work documentation. We also conducted all necessary site sampling and analytical programs. About 8,600 cubic yards of metal sludges containing copper, chromium, lead, nickel, and cyanide were excavated, manifested, and removed from the site over a two-month period.

- **Styrene Monomer Spill from Train Derailment, Chesapeake & Ohio Railway, Pearl, Michigan**

A remedial action designed and managed by WWES for a spill of 22,000 gallons of styrene monomer included immediate excavation and skimming, construction of a slurry wall to contain the contaminated ground water and the development of an aeration treatment system that removed styrene from the ground water by a combination of volatilization and polymerization.

- **Total Industrial Site Cleanup**

The challenge was to demolish buildings and successfully find, map, delineate, and clean up hazardous industrial residues to acceptable future risk levels that were not yet fully recognized by the state agency. WWES developed cleanup criteria for the organic and inorganic compounds discovered on the site using a blend of risk assessment techniques and typical urban concentrations surveyed by other investigators. We then mapped the contamination zones, which included a former heavy metals wastewater and sludge treatment facility, a RCRA hazardous waste storage area, a leaking underground tank farm, concrete containment bunkers serving large presses, a major power substation with PCB transformers, a parking lot, and a berm structure placed on fill containing hundreds of buried waste drums. The zones also included miscellaneous aboveground storage tank areas and solvent sluiceways, wastewater pipeline corridors, and wetland restoration. Today, aside from minor ground water contamination affected by a CERCLA site to the north, this site is clean, is covered with dune grass, and is ready to become part of an eventual \$250 million lakefront development project.



- **Hydrogeologic Investigation of Ground Water Contamination, Brooks & Perkins, Cadillac, Michigan**

Organic solvents, used for degreasing aluminum sheets, were discovered in the plant's discharge causing contamination of the ground water supply. Preliminary investigation determined the extent of contamination. Eight wells were installed and two contaminated aquifers were identified. Further investigation identified the source and off-site extent of contamination and evaluated remedial options for cleanup.

- **Cleanup of Contaminated Ground Water, Organics/LaGrange, Inc., Fennville, Michigan**

A hydrogeological investigation found process chemicals (chloroform and methylene chloride) had percolated into a usable aquifer through a drainfield. Forty-one observation wells were installed and soil borings were completed to determine the extent of contamination. It was found that the plume had migrated beyond the company's property and a ground water capture system was designed and installed consisting of five purge wells. In-situ permeability test data and an analytical model were used to help design the purge well system. An AquaDetox air-stripping unit with vapor emission controls was designed to treat 100-150 gpm of captured contaminated ground water. The treated water is discharged to nearby surface waters.

- **Ground Water Treatability/Pilot Project**

This project was recently completed for a major chemical company site in the southern United States. Another consultant had developed a purge well system and the water was being treated by a very inefficient, trayed steam stripper. Our semi trailer-mounted mobile organics separations unit was deployed on site to evaluate steam stripping under partial vacuum and at atmospheric conditions on a sidestream of purged ground water. When free distillate oils began appearing in the influent, with some process adjustments, we proved that atmospheric steam stripping was the preferred mode of operation and that the process would achieve the desired effluent concentrations at vapor rates of less than 60 percent of their current process. We have now designed a full scale unit which includes oil removal and inorganic water conditioning processes.



Environmental Compliance Services

REPRESENTATIVE EXPERIENCE ENVIRONMENTAL COMPLIANCE SERVICES

Following are brief descriptions of several environmental compliance projects completed by WW Engineering & Science. This is by no means a complete list of our compliance-related projects, but it serves to indicate our experience and capabilities. It is important to keep in mind that our Environmental Compliance Group is supported by our other in-house professional services including:

- ***Hydrogeology/Geophysics***
- ***Engineering (all disciplines)***
- ***Laboratory Services***
- ***Soil and Groundwater Remediation***
- ***Storage Tank Management***
- ***Construction Related Services.***

Beginning with any phase of a project's life, we have the capability to take that project to completion.

- **Environmental Site Assessments, Multi-location Project, Michigan**

Phase I environmental site assessments of 58 sites were performed for a major lending institution over a two-month period. The final report was organized and summarized with a numerical system which allowed each site to be referenced separately and provided a means for quality assurance review throughout the project. For those sites where further investigation was warranted, WWES ***designed and implemented Phase II investigations*** to specifically address the environmental concerns at each site. These involved a continued monitoring program of on-site water supplies, investigation of remediation and cleanup activities at adjacent properties, and subsurface hydrogeological and geophysical investigations.

- **Site Assessment and Development of an ECRA Sampling Plan, Nutley, New Jersey**

As a result of a change in corporate ownership, the client was required to comply with ***New Jersey's Environmental Corporate Responsibility Act*** to ensure that industrial sites involved in real estate transactions had no potential environmental liabilities. WWES conducted the initial field investigation which included field sampling, soil and ground water analysis, and an evaluation of the hydrogeologic conditions at the site. A detailed site sampling plan was then developed based upon the findings of the assessment.



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- **Management of "106 Order" Hazardous Waste Cleanup at Michigan Environmental Services Company for Group of Industries identified as "Responsible Parties", Flat Rock, Michigan**

WWES managed, directed, and completed an extensive cleanup of a site where *PCB-contaminated waste oils* were stored in above-ground tanks and drums. The work was required by the U.S. EPA under a *CERCLA 106 Consent Order*. Technical assistance was provided in developing the work plan during consent order negotiations and, when signed, WWES served as the coordinator for the responsible parties.

- **Environmental Site Assessment of a Stone Quarry Operation, Northern Michigan**

The *14,000 acre site* included a quarry, stone processing plant, a harbor dock facility, offices, and a maintenance facility. The assessment included an investigation of the operation areas and a perimeter and access road inspection of the overall site, interviews with plant officials and regulatory authorities, and a review of applicable agency records. The following areas associated with potential environmental risk were evaluated: *solid and hazardous waste handling and disposal; underground storage tanks; asbestos containing materials; and transformers or oils containing PCB's*.

- **Environmental Site Assessments for Five Heat Treating Facilities, Michigan, Illinois and Indiana**

The assessments included a walk-through survey of each plant, interviews with responsible plant officials, reviews of applicable agency records, and the preparation of a report summarizing the findings at each site. The assessments focused on the critical evaluation of evidence indicating the presence of asbestos-containing materials, transformers/capacitors or oils containing *PCB's, hazardous wastes, UST's, prior spills or leaks*, and adverse off-site environmental impacts.

- **Inspection of an 8-Story Apartment Building, Davenport College, Milwaukee, Wisconsin**

The apartment building was inspected and reviewed for conversion to a dormitory. The inspection included structural/architectural aspects, electrical and HVAC systems, fire detection and suppression systems, and presence and identification of any asbestos-containing materials. Homogeneous areas throughout the building were identified, the friability of *suspected ACM's* was assessed and representative bulk samples of suspected ACM's were collected. A *Special Operations and Maintenance Program* was developed to minimize the release of airborne asbestos fibers related to maintenance activities.



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- **Environmental Site Assessments, Specialty Chemical Manufacturer, Canada, Massachusetts, and Connecticut**

The client was evaluating whether or not to purchase several paint manufacturing facilities. The assessments included a visual inspection of each site, interviews with personnel, inspections of adjacent properties, and reviews of agency records and correspondence. The subsequent report made recommendations regarding need for further investigation, *engineering modifications* and improved housekeeping procedures.

- **Surface Impoundment Retrofitting Variance Petition, Dow Chemical USA, Midland, Michigan**

WWES prepared the Petition to demonstrate that the client's tertiary wastewater treatment impoundment is exempt from the minimum technology requirements specified in the *1984 amendments to RCRA*. This petition showed that the impoundment was designed and operated to eliminate the need for the double liners and leachate collection systems outlined in RCRA. The U.S. EPA accepted the Petition as prepared by WWES representing *a substantial dollar savings* to Dow.

- **Environmental Site Assessment for a Shopping Mall, Southfield, Michigan**

In addition to the typical items investigated during a site assessment, all suspect *asbestos containing materials* were identified, homogenous areas were assigned, representative bulk samples were collected and analyzed, and a *Special Operations and Maintenance Program* was developed, based on the analytical results of the samples collected.

- **Best Management Practices Plan, Automobile Manufacturing Plant, Syracuse, New York**

WWES prepared the Plan, as required by the *NPDES water discharge renewal permit*, after undertaking a comprehensive review of the plant's hazardous material and waste management procedures. The Plan included recommendations on the development of containment structures, preventive maintenance programs, facility inspections and audits, and personnel training programs.

- **Revision of Spill Prevention Plan, Teledyne Continental Motors, Muskegon, Michigan**

WWES reviewed and updated the existing *Spill Prevention Plan* which it had prepared originally in 1981. The plan establishes procedures for preventing and responding to the discharge of oils and hazardous materials from storage and use areas, manufacturing processes, treatment systems, and areas receiving bulk shipments. Necessary modifications were made to reflect changes in both the regulatory requirements and in the facility itself.



- **RCRA Interim Status Ground Water Monitoring - Waiver Reports, Chemical Manufacturer, Michigan**

In accordance with **40 CFR 265.93** and through investigations, WWES demonstrated that four hazardous waste management facilities qualified for waiving the interim status ground water monitoring requirements under RCRA.

- **RCRA Surface Impoundment Closure Plan, Southern Michigan**

WWES completed the closure plan including detailed plans and specifications, bid documents, and a construction quality assurance document for **five non-hazardous surface impoundments** for a facility manufacturing industrial chemicals. Pre-closure activities for two of the impoundments included **protective filing under RCRA Part A** in 1980 and **delisting** the impoundments in 1986 after 6 years of operation in accordance with RCRA's interim status rules. The remaining three impoundments were regulated under **Michigan Act 245** in accordance with a ground water discharge permit. The two-phase, **environmentally sound closure** of the five impoundments was completed in 1989.

- **Environmental Assessment and Compliance Audit of a Manufacturing Facility, Michigan**

WWES represented an international corporation in their evaluation of a Michigan manufacturing business and its associated 80,000 square foot facility for acquisition. In addition to the Phase I Environmental Site Assessment typically performed for property acquisitions, WWES also conducted an **Environmental Compliance Audit** to evaluate the business's compliance status with state and federal concerns pertaining to regulatory compliance issues, off-site disposal of hazardous wastes, and past chemical releases at the site.

- **Preparation of Delisting Petition for F006 Wastes, Howmet Turbine Components, LaPorte, Indiana**

WWES conducted a comprehensive investigation of the toxicity of sludges generated from the treatment of electroplating process wastewater (RCRA-listed hazardous wastes). The study concluded that the client's wastes did not meet the criteria of EP-toxicity for which they were listed and, subsequently, WWES developed the documentation necessary to **petition the EPA** to remove the sludge from the list of RCRA hazardous wastes.

- **Environmental Assessment of Stream and Railroad Right-of-Way for Arsenic Contamination, The Chessie System, Watson, Indiana**

The project was initiated as a result of cattle deaths attributed to arsenic poisoning. Arsenic found on the railroad right-of-way, and possibly picked up by a stream that traversed both the right-of-way and the cattle owner's property, was the suspected source. The assessment included **extensive sampling** and **stream flow** and **water**



quality measurements during wet weather to determine if "pollutant slugs" were being carried by the stream. The investigation showed that the existing arsenic levels found in the railroad right-of-way *were not a significant environmental hazard* and could not have been the source of stream contamination.

- **Work Plan Development and Consultation on Section 106 Consent Order for Auto Ion Site, Kalamazoo, Michigan**

The EPA issued a *CERCLA Section 106 Consent Order* to the client to clean up a site containing metal plating hazardous wastes. WWES worked with the client committee, its attorney, and the EPA to develop a work plan, sampling plan, and health and safety plan to implement the conditions of the consent order.

- **Hazardous Waste/Hazardous Material Training Program, AC Spark Plug Division, General Motors Corporation, Flint, Michigan**

To satisfy corporate directives and as specified in CERCLA, WWES developed *employee training modules* for AC Spark Plug including: introduction to environmental regulations; hazardous waste management and emergency response; toxic organic material management; and spill response (SPCC). After a comprehensive investigation of all plant areas, scripts for each module were prepared in cooperation with management and the UAW. The client's video department prepared the video tapes.

- **Hazard Communication Program and Training, Paragon Die & Engineering Company, Grand Rapids, Michigan**

In accord with the Federal Hazard Communication Standard and the *Michigan Right-to-Know Law*, WWES prepared a *written hazard communication program* for this client. The program included an evaluation of Material Safety Data Sheets, the implementation of employee training, and creation of informational materials.

- **Act 64 Hazardous Waste Management Unit Closure Report, Buick-Oldsmobile-Cadillac, General Motors Corporation, Flint, Michigan**

Due to discontinued manufacturing processes and modified waste handling practices, the plant no longer needed to operate as a permitted hazardous waste storage facility. WWES developed *closure plans* for the container and tank storage areas. When approved, WWES managed the closure in accordance with *RCRA and Act 64* requirements. WWES also conducted all necessary sampling and analysis of the closure area to substantiate a "*clean closure*".

- **Michigan Act 64 Operating License Application, OMI International Corporation, Warren, Michigan**

WWES prepared the necessary documentation for a *RCRA Part B Permit Application* for hazardous waste drum and tank storage areas. The project was initiated and



completed in 1984. In 1985, the Michigan DNR was authorized to administer *Act 64* in lieu of RCRA. OMI's Act 64 Operating License was called in. WWES then evaluated and updated the existing application and made the necessary modifications to reflect regulatory changes and facility modifications.

- **Environmental Assessment, Emergency Response Plan, and Best Management Practices Plan, Airborne Express, Inc., Wilmington, Ohio**

WWES performed a thorough environmental assessment of the facility to obtain information for the development of the Emergency Response and Best Management Practices Plans. The results were summarized in a report identifying potential *Clean Water Act* or RCRA compliance problems and necessary changes. The Emergency Response Plan was designed to satisfy the *Spill Prevention Control and Countermeasure* Requirements as well as the *Contingency Plan* Requirements.

- **Environmental Regulatory Compliance Program, Quanex Corporation, Michigan Seamless Tube Division, South Lyon, Michigan**

WWES developed a comprehensive environmental regulatory compliance program for the facility including a RCRA Part B permit application, a ground water monitoring program, design of a *solid waste management facility*, and the design and construction of an *industrial wastewater pretreatment facility*.

- **Environmental Assessment, Future Industrial Park, Berrien County, Michigan**

WWES conducted and completed a Phase I environmental assessment on a 275-acre parcel of land, which included a *covered landfill* and a *wetland* area. The assessment efforts were directed at the factory associated with future site development including site boundary wetlands. The concerns led to a targeted subsurface investigation in the parcels adjacent to the landfill for soil foundation stability, ground water quality and landfill gas (methane) detection.

- **SARA Title III Reporting Services for Calendar Years 1987, 1988, and 1989, Bronson Plastics Division, Bronson, Michigan**

Preparation of notification letters, release calculation and notification sheets, Hazardous Materials Inventory Lists, Tier I(s)/II(s), and *U.S. EPA Form R(s)* for three calendar years.

- **National Pollutant Discharge Elimination System (NPDES) Permit Application, Georgia**

WWES conducted effluent monitoring, laboratory analyses, and prepared a *NPDES permit application* for a chemical manufacturing facility planning to reconfigure and improve its wastewater treatment system. Special *grab and composite sampling* and



mathematical models were used to determine the final effluent quality that would result from the modifications.

- **Regulatory, Environmental, and Technical Feasibility and Liability of Siting and Operating a Sanitary Landfill, West Virginia, Pennsylvania and Georgia**

The project was prompted by the *increasingly difficult and serious waste management problem* and the possible solution using interstate transportation from the point of solid waste generation to a regionally located sanitary landfill. WWES evaluated the feasibility, risk, and the liability of siting, designing, operating, and closing a municipal waste landfill in Pennsylvania, Georgia, and West Virginia, including the impact of proposed changes to *RCRA Subtitle D* regulations. WWES provided a recommended state-of-the-art design and operating plan for a 1,000-acre landfill including the estimated costs for developing and operating such a landfill based on a 2,000-ton per day flow and an 8,000-ton per day flow. Predesignated priority areas in each state were identified based on geological and hydrogeological evaluations. After these extensive analyses were completed, WWES determined that *such a venture could be successfully undertaken*.

- **Wetland Mitigation, Lapeer, Michigan**

An environmental assessment was prepared for a proposed industrial park, and wetland areas were identified. One wetland was not able to be protected. It was not regulated by *Michigan's Wetland Protection Act* but, due to federal funding, was subject to *Presidential Executive Order #11990 (Protection of Wetlands)*. A wetland mitigation plan was prepared in cooperation with the *U.S. Fish and Wildlife Service*. The approved wetland is complete allowing for completion of the industrial park, which will be of *considerable economic benefit* to the City of Lapeer.

- **Environmental Compliance Audit and Phase I Site Assessment, Hillsdale, Michigan**

An *environmental compliance audit* and a Phase I site assessment were conducted by WWES on behalf of a manufacturing and testing facility that was merging with a large European-based chemical manufacturer. The objectives of WWES's services were to evaluate the facility's various environmental programs for areas of non-compliance, provide recommendations for correcting any identified deficiencies before the merger, and determine if there may be any potential environmental liabilities associated with the site. As part of their due diligence, the resulting WWES reports were reviewed by the chemical manufacturer's corporate environmental staff who were satisfied that environmental issues at the facility were accurately and thoroughly represented.



Storage Tank Management Services

REPRESENTATIVE EXPERIENCE STORAGE TANK MANAGEMENT SERVICES

Following are brief descriptions of several tank management projects completed by WW Engineering & Science. This is by no means a complete list of our tank-related projects, but it serves to indicate our experience and capabilities. It is important to keep in mind that our Tank Management Group is supported by our other in-house professional services including:

- *hydrogeology/geophysics*
- *engineering (all disciplines)*
- *laboratory services*
- *environmental compliance*
- *construction related services.*

Beginning with any phase of a project's life, we have the capability to take that project to completion.

- **Underground Storage Tank Removal, St. Joseph, Michigan**

WWES managed and directed the complete closure of *six underground storage tanks* on an industrial site. It was necessary to conduct a geophysical investigation to locate the tanks prior to undertaking the closure. Using a magnetometer in conjunction with ground penetrating radar, the tanks were located and past tank removals at several locations were verified. Because *water contamination* had been reported in the area, the removal methods were designed to determine the condition of the tanks and associated fittings, to evaluate the tanks as a possible contamination source, and to document all data for potential litigation.

- **Underground Tank Farm Removal, Holland, Michigan**

WWES managed and coordinated the closure/removal of *eighteen underground storage tanks* ranging in size from 2,000 gallons to 12,000 gallons which had contained alcohol and petroleum-based solvents used in the manufacture of pharmaceuticals. The project also included the *design and construction of a new state-of-the-technology 18-tank above-ground storage facility* including secondary containment structure, fire protection system, transfer piping system and inventory control system.

- **Storage Tank Removal Program, Southwest Michigan**

Plans and specifications were prepared for the removal of *eleven underground oil storage tanks*. The construction phase included: demolition and removal of a concrete slab above ten underground tanks; removal of ten underground storage tanks; removal of one underground oil skimming holding tank outside a storm water



treatment building; cleaning eleven below-ground storage tanks before removing; removal and disposal of all liquid residue in the storage tanks; backfilling, compacting, and regrading the tank farm.

- **On-Going UST Closure/Removal/Replacement Program, Major Automobile Manufacturer, Flint, Michigan**

WWES's most recent project for this division is the complete project management for the removal phase of *50 UST's located in 6 tank farm locations*. These will be replaced with above ground tank facilities. WWES will also provide criteria review for the new facilities. Past projects have included the closure of five underground tanks which previously had been used to store flammable liquids and the closure of four underground tanks, two of which contained *RCRA hazardous wastes*.

- **On-Going Remedial Investigation/Remedial Action, Parchment, Michigan**

Nearby *shallow domestic wells* were impacted with BTX compounds. Two existing gasoline stations as well as 2 former gas station locations were upgradient. WWES performed a three-phase hydrogeologic investigation to determine the extent of contamination. A test/purge well was installed and *aquifer test* performed with temporary discharge to POTW. A *soil vapor recovery* pilot test (SVR) was performed as part of the engineering evaluation of source area cleanup alternatives. Treatment alternatives were evaluated for groundwater and soils and recommendation made to the client for a cost effective and environmentally sound system.

- **Hydrogeological Investigation and Remedial Action Program, Dowagiac, Michigan**

The project involved a three-phase hydrogeological investigation of ground water contamination from degreasing solvents. Identified sources of contamination included *buried tanks*, buried sludges, and contaminated soils near the *oil/water separator*. A twelve-well purge system was designed and constructed with purged ground water pumped to a central AquaDetox air-stripping system for treatment.

- **Hydrogeologic Evaluation, Underground Storage Tank Closure and Remedial Action, West Chicago, Illinois**

A hydrogeologic evaluation addressed the condition of soil and ground water adjacent to *toluene and isopropyl alcohol underground storage tanks*. It was determined that only the toluene tank was losing enough liquid to qualify as leaking. With the aid of *soil gas sampling* followed by several new monitoring wells and borings installed around the tank site, the direction of ground water flow and the concentration of toluene was determined. Samples were analyzed by the WWES' Environmental Laboratory. The impact from the tank leak was contained predominantly within the excavation zone. Remedial activities consisted of tank and impacted soil removal and disposal. Closure documentation was proposed using *risk based cleanup levels*.



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- **Tank Management Evaluation, Major Automobile Manufacturer, Dearborn, Michigan**

WWES performed a tank management evaluation of *thirteen underground storage tanks* in accordance with the newly-promulgated federal regulations. Our evaluation included a preliminary hydrogeological assessment and evaluation of tank management activities, including cost estimates for tank removal and new installations.

- **Underground Solvent Storage Tank Farm, Major Chemical Productin Plant, Kalamazoo, MI.**

WWES designed one new underground solvent storage tank facility for a major chemical production plant. Features included the removal of *7 existing underground tanks and installation of 6 double walled tanks* with capacities of 30,000 and 40,000 gallons, leak detection systems and tank certifications per *RCRA regulations*.

- **Underground Storage Tank Removal, Calhoun Co. Road Commission, Marshall, Battle Creek and Albion, Michigan**

Excavation and removal of *twenty-three underground fuel storage tanks* at several locations in southern lower Michigan. Services consisted of *soil, air and ground water sampling*, development and implementation of a site safety plan, tank decontamination, excavation and removal procedures, and regulatory compliance services.

- **Fuel Tank Closure, Major Food Manufacturing Company, Battle Creek, Michigan**

WWES planned, conducted and documented the in-place closure of a *20,000-gallon fuel tank* in accordance with the recently released UST rules. The procedure was considered complete following an adjacent soil check for tank releases, tank cleaning, filling with an inert material and complete documentation of all closure activities.

- **Evaluation of Underground Tank System, Andrews University, Berrien Springs, Michigan**

Working with the University maintenance staff, WWES evaluated *29 existing underground tanks* for storage of various nonhazardous liquids on the campus. The project included initial tank inventory and location map, tank registration, evaluation of alternatives and recommendations for compliance, and development of an implementation schedule.

- **Underground Tank Investigation, Major Automobile Manufacturer, Syracuse, New York**

The investigation of contamination of soils and ground water around *three underground paint solvent storage tanks* included the placement of monitoring wells and a purge well, the analysis of ground water and soil samples, participation in the negotiation of a consent order, and the submission of a final report with recommendations.



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- **Act 64 Hazardous Waste Management Unit Closure Report, Major Automobile Manufacturer, Flint, Michigan**

WWES developed closure plans for the *container and tank storage* areas as required by RCRA and Act 64.

- **RCRA Part B Permit Application, National Corporation, Warren, Michigan**

WWES prepared a *RCRA Part B Permit Application* for the corporation's *two hazardous waste drum storage areas and tank storage area*. The work required the development of a general site description, a waste analysis plan, contingency plan, inspection schedules, and a closure plan.

- **Tank Closure, Constantine, Michigan**

WWES managed and coordinated the *closure of 12 petroleum, fuel and oil tanks* in three areas.

- **Tri-City International Airport UST Assessment and Remediation, Freeland, Michigan**

An assessment of the airport's *20-tank fuel storage depot and 8 individual UST locations* was performed to determine the extent of release contamination prior to closure and construction of a replacement above ground facility. Upon completion of the new facilities, all existing tanks will be cleaned, removed, and disposed of off-site along with related piping. *Contaminated soil* will be removed from the tank area and consolidated on-site for a two-stage treatment program. Stage 1 will remove volatile organic compounds through the use of a *vapor recovery system*, and Stage 2 will reduce Total Petroleum Hydrocarbons and Polynuclear Aromatic Compounds through the use of *enhanced biodegradation*.

- **Kent County International Airport UST Removal, Grand Rapids, Michigan**

Engineering services were provided for the removal of *three 10,000 gallon underground storage tanks*. The project involved overseeing the initial abatement and site investigation/characterization, submitting the required reports to Michigan Fire Marshal Division and MDNR, preparing technical specifications and drawings for the removal, and providing construction management services and on-site inspection during removal.

- **Additional Underground Storage Tank Projects**

Analyses similar to the ones listed above for Kent County and Tri-City Airports have been performed for the Livingston County Airport, Kinross Township, Village of Paw Paw, Amway Corporation at Kent County International Airport, Van Buren County Road Commission, City of Grand Rapids, Village of Shelby and City of South Haven.



Landfill Services

REPRESENTATIVE EXPERIENCE LANDFILL SERVICES

The procedures used to manage solid waste are undergoing considerable change. WW Engineering & Science understands the effects of these changes on local communities and is familiar with the complexities of solid waste management. Our staff of professionals has acquired the solid waste management expertise and the experience necessary to offer complete consulting services that range from site selection for solid waste facilities to landfill closure. In addition, we offer solid waste management planning services, as well as the actual operation of landfill facilities and the post-closure monitoring of closed facilities. From start to finish, we strive to provide the highest quality of service available.

Following are brief descriptions of several landfill projects completed by WW Engineering & Science. This is by no means a complete list of our landfill projects, but it serves to indicate our experience and capabilities.

- **Regulatory, Environmental, and Technical Feasibility and Liability of Siting and Operating a Sanitary Landfill, West Virginia, Pennsylvania and Georgia**

WWES evaluated the *feasibility and the liability of siting, designing, operating, and closing municipal waste landfills* in Pennsylvania, Georgia, and West Virginia. The risk and liability issues associated with such an undertaking were also examined. WWES then provided a recommended state-of-the-art design and operating plan for a 1,000-acre landfill based on predesignated geological and hydrogeological priority areas in each state.

- **Soil Testing - Landfill Liner, Chemical Waste Management, Kent County, Michigan**

Soil samples were collected in a grid pattern from each of four *hazardous waste* containment trenches. The samples were taken from the leachate collection sands and the underlying clay liner and were analyzed for chemical concentrations. Excavation and remediation of the site was then completed.

- **Michigan Act 64 License Application Assistance, Client Confidential, Kalamazoo, Michigan**

Professional, multidisciplinary services were provided to assist a *major chemical manufacturer* in its permit application for an existing hazardous waste management facility. The application was submitted in accordance with *Michigan's Hazardous Waste Management Act* (Act 64). In order to complete the application, professional services in hydrogeologic investigation, environmental assessment, failure mode assessment, and engineering review were required.



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- **Technical and Cost Evaluation of a Proposed Type II Landfill Site, Abitibi-Price, Alpena, Michigan**

The objectives of this study were to prepare a **preliminary design and cost estimate** for *converting a 200-acre site* owned by the client into a Type II or Type III landfill for the disposal of wood and paper wastes.

- **Act 64 Permit Application, Dow Chemical USA, Midland, Michigan**

WWES prepared the original Michigan *Act 64 construction permit* application for the Salzburg Landfill, which included a *detailed hydrogeological investigation, environmental assessment, landfill design, failure mode assessment, spill and accident prevention plan and contingency plan, and emergency procedures*. This site is still the only hazardous waste landfill in Michigan approved by the Act 64 siting board. In more recent years, WWES has prepared the ground water monitoring portion of *RCRA Part B applications* for the Salzburg Landfill and Dow's other land disposal and storage facilities in Midland.

- **Landfill Cell Dye Testing, Cascade Resource Recovery/Waste Management, Kent County, Michigan**

The project involved the *dye testing of four hazardous waste landfill cells* using uranine and Rhodamine WT, fluorescent dyes as the tracer to determine the potential for gross leakage. Samples were periodically collected from the leak detection system and tested using a fluorometer and spectrophotometer.

- **Sludge Composting Site Development, Bi-Product Systems, Inc., Detroit, Michigan**

The use of an existing landfill site to *compost* the *sludge* produced from wastewater treatment processes was proposed by the client. An evaluation of the proposed landfill site was conducted and the current and future impacts from waste disposal and sludge composting were studied. The evaluation included performing the *required field surveys, hydrogeologic studies, laboratory analyses, and environmental impact assessments*.

- **Type III Landfill, S.D. Warren Company, Muskegon, Michigan**

WWES completed all of the work necessary to assist the client in obtaining a *Type III landfill construction permit for power plant combustion ash*. This involved hydrogeological studies, environmental assessment, alternative site evaluation, facility design, listing of the site in the county plan, and preparation of the permit application.



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- **Wayne County Air Use Permit Application, Riverview Energy Systems, Riverview, Michigan**

WWES prepared a permit application for a proposed renewable resource facility which involved the use of *landfill gas-fired turbines* to generate electricity for the Detroit Edison power grid. The gas turbines would be powered solely by gas generated from raw garbage, gas that was previously vented directly to the atmosphere. It was demonstrated through *dispersion modeling* that the emissions from the gas turbines would not pose an unacceptable risk to the environment or to the general public.

- **Hydrogeological Investigation of a Landfill, James River Corporation, Kalamazoo, Michigan**

This study sought to *define the hydrogeologic characteristics* of the client's *112-acre landfill* and to determine what effect, if any, the disposal of solid wastes had on ground water quality. It was also to determine whether the landfill could be licensed under the existing rules and regulations of *Act 641*, what classification the landfill would receive under this Act for the disposal of wastepaper and dewatered paper sludge, and what steps would have to be taken to close the landfill if it could not satisfy the requirements of the law.

- **Southeast Berrien County Landfill, Southeast Berrien County Landfill Authority, Buchanan, Michigan**

Fast track construction management of landfill construction of 10 acre site into leachate collection, double liner, and liner failure detection system.

- **Milan Landfill Closure, Rumpke of Indiana, Inc., Milan, Indiana**

WWES prepared the Milan Landfill *complete closure and post-closure plan* application package necessary to fulfill the State of Indiana, Department of Environmental Management rules and regulations. A quality control/quality assurance program was provided to assure the facility was closed and monitored properly. Cost estimates were also prepared for financial bonding purposes.

- **El-Ko Landfill Closure Plans, Beer & Slabaugh, Inc., Nappanee, Indiana**

WWES prepared the *closure plans for the El-Ko Landfill*, a solid waste facility in northern Indiana, in accordance with a Consent Decree issued to the owner. This closure plan included an operational plan showing the final area of filling along with the areas to receive final clay cover material.

- **Anderson Road Landfill Reclamation Plan, Monroe County, Indiana**

WWES prepared the *reclamation plan* for the existing Anderson Road Landfill in accordance with the State of Indiana Stream Pollution Control Board *Consent Decree*. The plan was designed to redirect rainfall runoff from passing over existing



denuded and borrow areas. A sediment basin was included in the design to maximize the quality of the runoff prior to its leaving the site. The project is now continuing into a *ten-acre expansion* for this solid waste facility including a hydrogeologic study, landfill design, operational plan, cost estimates and a construction quality control/quality assurance plan. In addition, the closure and post-closure plans and cost estimates for construction and closure were provided.

- **Evaluation of the Mobility of Fluorobenzene in Compacted Landfill Clay Soils, Michigan**

Experimental determination of the mobility of fluorobenzene in selected clay soils. Four other chemicals were monitored in both the landfill's influent and collected percolate. A closed testing apparatus was specially designed to eliminate possible loss of volatile chemicals during testing.

- **RCRA Groundwater Monitoring System, Hydrogeologic Investigation, Part B Permit Application (Hydrogeology volume), EnviroSAFE Services of Ohio, Inc., Oregon, Ohio**

A comprehensive hydrogeologic study was conducted and the hydrogeologic portions of the *Part B permit application* authored for the ESOI Otter Creek and Wynn Road facilities. The Otter Creek facility is the *largest commercial secure (hazardous waste) landfill in the State of Ohio*. The project included the design and installation of a CFR 40 Part 264 RCRA groundwater monitoring system.

- **Hydrogeologic Site Assessment and Remediation Investigation of a Solid Waste Landfill, Laidlaw Waste Systems, Inc., Adrian, Michigan**

A *hydrogeologic site assessment* was conducted as part of the closure of the existing site. Initial phases of the investigation involved design and installation of a *groundwater monitoring system*, performance and evaluation of *aquifer tests*, installation of *leachate test wells*, and compilation of a comprehensive hydrogeologic report. Subsequent phases of the study entailed a *remediation investigation* which included defining the *vertical and lateral extent of contamination* using a portable gas chromatograph for the detection/identification of Volatile Organic Compounds in groundwater samples, *design and computer modeling of remediation measures*, and correspondence and *negotiations with state regulators*. A remediation system consisting of 17 purge wells was subsequently installed and tested. The effectiveness of the system is currently being monitored through *quarterly performance evaluations*. A *geotechnical evaluation* of a proposed new disposal area was also conducted.

- **Hydrogeologic and Remedial Investigation at a Closed Solid Waste Site, Browning-Ferris Industries, Oakland County, Michigan**

A *comprehensive hydrogeologic and remedial investigation* was completed at a closed solid waste landfill which was being considered for purchase by the client.



The purposes of the investigation were to further characterize the *site hydrogeology* and to define the horizontal and lateral extent of *existing groundwater contamination*. Initial phases of the study included *geophysical investigation* (resistivity) and *soil gas surveys*. Soil gas samples were collected and analyzed in the field with a portable gas chromatograph. Borings and wells were located based on the results of the geophysical and soil gas survey to provide groundwater quality data points and stratigraphic information. Water samples were collected from all existing monitor wells and were analyzed in the field with the *portable gas chromatograph* for the detection of volatile organic compounds. *Computer and analytical modeling* was performed to evaluate potential remedial designs. The entire field investigation and preparation of a comprehensive report were completed in less than three months.

- **Hydrogeologic Site Assessment of a Solid Waste Landfill, Envirite Corporation, Wyandotte County, Ohio**

A *hydrogeologic site evaluation* was conducted as a portion of the *Permit to Install* for closure of the present landfill and expansion of the facility. A *geotechnical evaluation* of the expansion area was performed which included logging of numerous soil borings, construction of detailed geologic cross sections, and *installation and testing of piezometers*. *An angle (45°) piezometer was installed and tested to evaluate the influence of fractures* on the hydraulic conductivity of till deposits. A *groundwater isotopic study* was completed which utilized tritium to gain information on recharge rates. A comprehensive hydrogeologic report was prepared and submitted to the Ohio EPA, Northwest District Office. Proposals for the installation of a groundwater monitoring system have also been submitted.

- **Hydrogeologic Site Assessment of a Solid Waste Landfill, BFI Corporation C&C Landfill, Marshall, Michigan**

An evaluation of the *groundwater monitoring* at the facility was performed as the initial portion of this investigation. A report was submitted to the Michigan Department of Natural Resources which reviewed the monitoring system, and made recommendations for the installation of additional wells. The additional wells were subsequently installed. A *comprehensive hydrogeologic report* was then submitted to MDNR, Jackson Office, as part of the licensing process.

- **Hydrogeologic Site Assessment of a Solid Waste Landfill, Laidlaw Waste Systems, Inc., Celina, Ohio**

A *hydrogeologic site investigation* was conducted and hydrogeologic report submitted to the Ohio EPA, Northwest District Office. The investigation included logging of numerous soil borings, installation of nine monitor wells, performance and analysis of *aquifer tests*, construction of geologic cross sections, water quality sampling and data evaluation, isotopic *analysis of groundwater samples for tritium content to gain information on recharge rates*, and installation of *methane monitor probes*.



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- **Dewatering Assessment and Geophysical Survey, BFI Hagman Road Landfill, Toledo, Ohio**

The dewatering of an active landfill cell was quantified and a *seismic reflection geophysical survey* was conducted to establish the depth to the top of bedrock.

- **Groundwater Monitoring System for a Solid Waste Landfill, Waste Management, Inc., Allen County, Ohio**

As part of the closure of the solid waste disposal facility, WWES prepared a plan for *upgrading the existing groundwater monitoring network*. WWES implemented the plan through the installation of several *methane gas detection wells* and two groundwater monitoring wells.

- **Hydrogeologic Site Assessment for a Solid Waste Landfill, The Roberts Landfill Company, Champaign County, Ohio**

A hydrogeologic site assessment was prepared for this facility as part of a Permit to Install Application closure plan. An *extensive geotechnical* study was performed including the installation of six monitoring wells. A comprehensive report is on file with the Ohio EPA, Southwest District.



Air Quality Services

REPRESENTATIVE EXPERIENCE AIR QUALITY SERVICES

Following are brief descriptions of air quality services projects completed by WW Engineering & Science. This is by no means a complete list of our projects in this area, but it serves to indicate our experience and capabilities. It is important to keep in mind that our Air Quality Group is supported by our other in-house professional services including:

- *Environmental Compliance*
- *Engineering (all disciplines)*
- *Hydrogeology/Geophysics*
- *Laboratory Services*
- *Soil and Ground Water Remediation*
- *Storage Tank Management*
- *Construction-Related Services.*

LICENSING AND COMPLIANCE

- **Confidential, State of Missouri**

WWES assembled a State of Missouri air permit application for the painting lines at a major automobile assembly plant. A Lowest Achievable Emission Rate (***LAER***) ***demonstration*** was also prepared for one of the coating lines at the facility.

- **TES Filer City Station, Filer City, Michigan**

WWES obtained an approved Prevention of Significant Deterioration (***PSD***) **permit** for the construction of a ***55-megawatt coal and woodwaste-fired cogeneration facility*** in Manistee County, Michigan. Ambient monitoring sites were located in the Manistee area to develop actual background data for sulfur dioxide. Two trailers were equipped with continuous sulfur dioxide analysis and data reduction equipment to telemeter data to the Grand Rapids office of WWES. Data was collected for 12 months. The data which was collected allowed the cogeneration project to proceed in the area.

- **Great Lakes Gas Transmission Company, Boyne Falls and Wakefield, Michigan**

WWES prepared a Prevention of Significant Deterioration (***PSD***) ***permit application, with a five-year dispersion modeling study*** for three ***natural gas-fired turbines*** at the Boyne Falls Compressor Station. WWES also prepared an Act 348 permit application for a replacement gas turbine at the Wakefield Compressor Station.



- **Gilbert/Commonwealth, Inc., East Lansing, Michigan**

Gilbert/Commonwealth, Inc. of Jackson, Michigan subcontracted WWES to conduct a Prevention of Significant Deterioration (*PSD*) *dispersion modeling demonstration* for a new *coal-fired boiler* at Michigan State University's T.B. Simon Power Plant in order to supplement their PSD permit application.

- **Confidential, Milan, Michigan**

WWES conducted a nationwide Lowest Achievable Emission Rate (*LAER*) *search* for a *major automobile manufacturer*. This project included an evaluation of the types of coatings, substrates, and application equipment being used in addition to determining the extent of emission add-on control equipment being incorporated at existing *plastic painting operations nationwide*. WWES also prepared *Act 348 air use permit applications* for a plastic gasoline tank fluorination system and the addition of a new mix tank to the plant's paint mix room.

- **Confidential, St. Charles, Michigan**

In response to odor concerns from nearby citizens and MDNR enforcement activities, WWES was retained to assemble and amend air use permits for **two fiberglassing facilities**. WWES also evaluated both the magnitude of a potential odor problem and possible cost-effective measures to reduce odors and air emissions to acceptable levels. This study included *extensive stack sampling*, plant *odor surveys*, facility *ventilation assessment*, *odor panel* and *dispersion modeling evaluations*. In addition, a nationwide search was conducted to determine the technical and economic feasibility of additional air pollution control equipment and possible raw materials substitutions to satisfy lowest achievable emission rate (*LAER*) *requirements*.

- **Confidential, Detroit, Michigan**

WWES was subcontracted to conduct a *dispersion modeling study* to assess the potential impacts from a *hospital waste incinerator* at a proposed governmental facility. The purpose of the project was to determine an incinerator design which would facilitate the air permitting process in the near future. As required for all hospital waste incinerators, a *risk assessment* was conducted for *possible carcinogenic compounds* in the exhaust stream. This assessment was completed for several stack scenarios including an evaluation of control technologies available for each situation.

- **Confidential, Grand Rapids, Michigan**

WWES prepared an air use permit application for a *plastic and metal coating operation*. The approval of the application was dependent upon WWES's ability to determine *VOC offsets* for the proposed project location, a *non-attainment area* for VOC's.



- **Confidential, Plainwell, Michigan**

A *Michigan Act 348 permit application* was prepared for a *75,000 pph gas-fired boiler at a paper manufacturing facility*. This equipment was initially subject to federal Prevention of Significant Deterioration (PSD) regulations. However, it was determined that, at a nominal cost, *Flue Gas Recirculation (FGR)* could reduce nitrogen oxide emissions sufficiently to *avoid PSD*. This resulted in a simplified permitting process and allowed the company to secure a permit in a more cost effective and less time-consuming manner.

- **Kellogg Company, Battle Creek, Michigan**

WWES conducted a complete *plant compliance audit* of all operations that contribute to airborne emissions from the facility. Process flow diagrams and air use permit amendments were prepared for sources which had been modified.

- **KB Lighting, Grand Rapids, Michigan**

A Best Available Control Technology (*BACT*) *analysis* was performed for a new coating line. *Thermal and catalytic incineration* and *carbon adsorption* were evaluated considering the net benefit of solvent recovery.

- **Autostyle Plastics, Inc., Kentwood, Michigan**

Dispersion modeling was conducted to evaluate potential emissions from this *plastic fascia coating* facility. Additionally, the company was required to conduct transfer efficiency testing of the coating lines. WWES *developed the testing protocol*, conducted the testing and prepared a report of the findings for the company.

- **Renosol Corporation, Farwell, Michigan**

WWES assembled *three air use permit applications* for new polyurethane foam lines. New air exhaust systems were also designed by WWES's Facilities Engineering Division.

- **Confidential, Hudson, Michigan**

Dispersion modeling was conducted for the emission sources at a *metals casting foundry* in order to determine compliance with National Ambient Air Quality Standards (*NAAQS*) and recommended MDNR limits related to *toxics, carcinogens, and odors*.

- **Indeck Energy Systems, Inc., Otsego, Michigan**

A *PSD permit application* was prepared for a *72 MW cogeneration facility*. The proposed facility included a 778 MM Btu/hr pulverized coal-fired boiler and an auxiliary gas-fired boiler with an input rating of 100 MM Btu/hr.



- **Gelman Sciences, Pensacola, Florida**

Air use permits were prepared for the company's new plant in Pensacola, Florida. The permit applications included *two membrane casting lines* with wet scrubbers, a fabric coater with a wet scrubber and siliconizing line with a condenser. *BACT analyses* were conducted for each of the proposed sources.

- **Abitibi-Price, Middlebury, Indiana**

WWES conducted an *environmental compliance audit* of the Middlebury facility. Sources of airborne emissions were evaluated against their permits to operate. Various prioritized recommendations were provided to achieve compliance with all current environmental regulations and to remain in compliance with anticipated expansion of the facility.

- **General Foods, Battle Creek, Michigan**

A complete *plant compliance audit* of all operations that contributed to airborne emissions from the plant was conducted. New *process flow diagrams* were prepared along with *revised emission inventory identification* for all sources. Recommendations to amend permits and assemble new permits were included in reports for each building at the facility.

- **Confidential, Lapeer, Michigan**

WWES assembled an *Act 348 permit application* for a plastic fascia coating facility. This was a *major source of VOC emissions* and located in a *rural non-attainment area for ozone*. A one-year dispersion modeling demonstration was required by the Michigan Department of Natural Resources (MDNR) in order to determine compliance with air quality standards and recommended MDNR limits related to toxics, carcinogens, and odors. A Lowest Achievable Emission Rate (LAER) *demonstration* was also necessary.

- **Wastewater Treatment Plant Audit, Battle Creek, Michigan**

WWES conducted an *air permitting audit* including an analysis of federal and state air-use regulations concerning *treatment plants*. All processes were identified, and WWES determined whether the source was permitted, met permit conditions, or required additional attention. Recommendations were provided for modifying processes to meet conditions, recording or monitoring operation of sources, amending existing permits, or preparing new permit applications. Follow-up assistance was also provided in various correspondence with the MDNR, Air Quality Division, for the treatment plant.

- **Borden Chemical of Seattle, Gaylord, Michigan**

WWES prepared an *Act 348 Permit to Install* application for a new *urea-formaldehyde resin plant*. This project was subject to a *21-day public comment period* and review by the Michigan Air Pollution Control Commission (MAPCC). Upon



completion of WWES's review, which not only looked at *expected air emissions* but also at *emergency emissions*, approval was recommended to MAPCC, which later voted 10-1 in favor of the project.

- **E.I. DuPont DeNemours & Company, Montague, Michigan**

An *Act 348 Permit to Install* was required by the MDNR prior to construction of the air-stripping system to be used in a proposed ground water cleanup project. (Pollutant-laden air exits at the top of the stripping tower and is filtered through a carbon vessel prior to release to the ambient air.) In order to obtain permit approval, WWES was required to demonstrate "environmental acceptability." This was accomplished by utilizing *computer modeling, emission rate calculations, and toxicity data*.

- **Three Rivers Area Hospital, Three Rivers, Michigan**

WWES assembled and submitted an *Act 348 permit application for a medical waste incinerator*. Through dispersion modeling, WWES demonstrated that the emissions from the incinerator would comply with applicable air quality standards.

- **University of Michigan, Ann Arbor, Michigan**

A PSD permit application, including a BACT analysis and a five-year dispersion modeling study, was prepared for a *cogeneration facility* in an existing powerhouse. The equipment requiring air permits included *two 3.8 MW gas turbines* with associated heat recovery boilers.

- **Texas Gas Resources Corporation (New River Company), Oak Hill, Virginia**

WWES performed an environmental exposure assessment of a *burning waste pile*. The study included an evaluation of *toxic and carcinogenic air emissions*, analysis of *soil samples*, and a toxicological *risk assessment*.

PARTICULATE TESTING

- **Cantech Environmental Systems, Inc., Detroit, Michigan**

WWES conducted a particulate emission study for Cantech Environmental Systems on their recently installed baghouse at the National Steel Company, Detroit, Michigan. The purpose of the study was to document the particulate emissions from the baghouse to verify that Cantech met their equipment guarantee. The particulate emission sampling was conducted using EPA Reference Method 5. The testing was observed and approved by the Wayne County Health Department, Air Pollution Control Division.



- **General Motors Corporation, Detroit, Michigan**

WWES conducted a paint particulate emission study on the main exhaust from the fan farm serving the entire painting exhaust system at the plant. The exhaust stack has a internal diameter of 28 feet and has an air flow of 1,000,000 cfm. Sampling for paint particulate emissions was coordinated so that normal spraying was being conducted throughout the plant during the testing. Collected samples were analyzed for total weight gain in order to determine the exhaust emissions from the stack in grains per thousand dry standard cubic feet.

- **Confidential, Kalamazoo, Michigan**

A major particulate emission survey was conducted for the client. WWES developed a plan to identify approximately 250 sources at the facility consisting of wet/dry rotoclones and baghouses. Particulate and PM-10 emission testing was conducted on approximately 20% of the sources and the results used to estimate the emissions from the remaining sources through comparison of process material handled and amount. Special sampling trains were developed in order to collect samples within 2"-6" non-typical exhaust ducts with process times ranging from 10 minutes to 30 minutes.

- **Monitor Sugar Company, Bay City, Michigan**

WWES was retained to perform particulate emission tests on the exhaust from boilers #1, #2, #3, and #4 and the sugar pulp driers #1, #2, and #3. WWES also certified two opacity monitors located on the common stack of the boilers. In addition to the particulate loading, aerodynamic particle size distribution for all sources tested.

- **Ford Motor Company, Dearborn, Michigan**

WWES was retained by Ford Motor Company to conduct a particulate emission study on two coal-fired boilers at their Rouge Steel Complex. Each boiler was sampled for particulate emissions employing EPA Reference Method 5 during maximum boiler steam production.

- **Hodgins Paving, West Branch, Michigan**

WWES conducted a particulate emission study for an asphalt paving company while producing both virgin and re-cycled material. Testing was conducted following the procedures of EPA Reference Method 5A.



VOLATILE ORGANIC COMPOUND TESTING

- **Ford Motor Company, Wixom, Michigan**

WWES assisted Ford Motor Company in conducting a transfer/capture efficiency study on three of their newly installed automotive coating lines at their assembly facility. Over the course of 3 weeks VOC emissions were determined on sources including incinerator inlets and outlets, carbon wheel outlets, booth exhausts, and the wet electrostatic precipitator control units. All testing was conducted according to Method 25A using Ratfisch analyzers and data loggers.

- **BASF Corporation, Detroit, Michigan**

WWES was retained by BASF Corporation, Coatings & Colorants Division, to conduct a VOC emission study on the resin manufacturing process. The purpose of the study was to document the VOC exhaust emissions from the kettles, phase separators, strippers/reactors, and thinning tanks associated with the process. WWES developed a sampling and analytical protocol for approval by the local agency before initiating sampling. The batch processes were continuously monitored from beginning to completion - 24 hours in some instances - using Ratfisch analyzers. Results from the total VOC analyzers were converted to reflect the compounds within the process by determining response factors for each compound to the calibration gas.

- **Confidential, Cadillac, Michigan**

WWES conducted a styrene emission study on a gel coating and resin spraying operation to determine compliance with applicable regulations. Samples were collected, simultaneously on each stack, using sorbent tubes and GC analysis, and using a continuous VOC analyzer calibrated with styrene.

- **Ford Motor Company, Wayne, Michigan**

WWES conducted a VOC emission survey on the exhausts from the Wet Precipitator Booth control outlets, Carbon Wheel outlets and the Incinerator inlet and outlets from three (3) different automotive coating lines. All testing was conducted according to EPA Reference Method 25A and employed Ratfisch analyzers. Data from the analyzers was directed to a data logger and strip chart recorder. In conjunction with the VOC study Ford Motor personnel were conducting Transfer/Capture efficiency tests.

- **Ford Motor Company, Louisville, Kentucky**

WWES conducted a VOC destruction efficiency study on six (6) Eiserman Thermal Incinerators. EPA Reference Method 25A procedures were used to conduct the VOC testing employing Ratfisch analyzers. The sampling and final report were completed within a two week time span to meet special time constraints for Ford Motor Company



- **LFC Power Systems, Hillman, Michigan**

WWES conducted a VOC emission study on a wood-fired boiler exhaust for the client in order to show compliance with an Air Permit condition. Initial sampling was conducted using EPA Method 25 procedures, as requested by the local regulatory agency. Upon receiving the results from the testing, WWES convinced the agency that due to interferences (high moisture, high CO) within the gas stream, Method 25A would be a more appropriate and accurate test procedure. A second series of VOC tests were performed using Method 25A, which showed greater consistency. The sampling and final report were completed on the same day and presented to the MDNR the following day at a commission meeting.

SPECIALIZED TESTING

- **LFC Power Systems, Hillman, Michigan**

WWES conducted an emission study on the exhaust of a wood-fired boiler for total particulates, multi-metals, benzo-a-pyrene and other pollutants. The metals testing was conducted following the EPA Multi-Metals draft procedure. During the sampling, the temperature was -10°F, thus special procedures were taken to allow sampling to continue without freezing of the collected samples. The Benzo-a-Pyrene testing was accomplished using the VOST procedure.

- **Confidential, Kalamazoo, Michigan**

WWES was retained by the client to conduct a hazardous waste trial burn at their biological incinerator. WWES developed a detailed sampling and analytical protocol for approval by the state regulator and EPA. Sampling was conducted for total particulates, multi-metals, POHC's (carbon tetrachloride and toluene), hydrogen chloride, and dioxins and furans while operating the incinerator at maximum conditions in addition to spiking the waste stream with waste solvents. During the emission sampling, samples of the waste streams were collected for analysis in order to determine destruction removal efficiencies to four 9's.

- **Confidential, Detroit, Michigan**

WWES conducted an emission study on a municipal waste incinerator for particulate, metals, HCL, and dioxins furans. Because of the configuration of the fans at the base of the outlet stack, cyclonic flow was present within the stack at the sampling location, thus sampling at each point was conducted at a different angle in order to be parallel with the flow. A detailed sampling and analytical protocol was developed prior to the sampling for approval by the local agency.



- **Confidential, Lansing, Michigan**

WWES was retained by a local hospital to conduct an emission study on their pathological incinerator for particulate, metals, HCL and specialized organics. Sampling was conducted following the appropriate EPA Reference Methods while the incinerator was operated a maximum conditions.

- **Confidential, Dearborn Heights, Michigan**

WWES has conducted annual emission testing on a municipal waste incinerator for the past four years in order to show compliance with county, state, and federal emission limits. Sampling has been conducted for total particulates, VOC, metals, HCL, and dioxins furans.

- **Ford Motor Company, Wixom, Michigan**

WWES conducted a formaldehyde emission study on a series of paint spray booth exhausts for Ford Motor Company. Testing followed the guidelines of NIOSH Method 3500 and was conducted during normal painting operations within the booth. The sampling was conducted in order to show compliance with existing permit conditions.

SO₂, NO_x, CO EMISSION TESTING

- **Ford Motor Company, Dearborn, Michigan**

WWES was required to conduct a sulfur dioxide emission study on one of the checkerwork heat exchangers at the soda-lime glass plant. This required sampling to be conducted for 15 minutes and then waiting 15 minutes for the next blow period. Four 15-minutes samples were collected for each of three tests conducted. Sampling for SO₂ was conducted employing EPA Reference Method 6C.

- **National Steel Corporation, Detroit, Michigan**

WWES conducted a sulfur dioxide emission study on the exhausts of the reheat furnace and a coal-fired boiler at the National Steel Corporation, Great Lakes Division facility in Detroit, Michigan. The sulfur dioxide emission testing was conducted at each source using an electrochemical analyzer and following the guidelines of EPA Reference Method 6C.

- **Monitrol, Lincoln, Michigan**

WWES conducted a Continuous Emission Monitor Certification study on a Nitrogen Oxide and Carbon Monoxide continuous monitor at a facility in Northern Michigan. Monitrol manufactured and installed the monitors at the facility and the testing was to show compliance with EPA performance Specifications 1, 2, and 3. WWES conducted a series of twelve 20-minute emission tests on the boiler exhaust for Nitrogen Oxide and Carbon Monoxide using EPA Reference Methods 7E and 10.



Boiler operational data and the plant CEM data were collected during each test. Results from the WWES testing was compared to the corresponding plant data to show compliance for relative accuracy.

- **University of Michigan, Ann Arbor, Michigan**

WWES conducted a Nitrogen Oxide emission study on the gas-fired turbine exhaust at the University of Michigan Powerhouse facility in Ann Arbor, Michigan. Testing was required to show compliance with the air permit limits according to the procedures outlined in EPA Reference Method 20. Nitrogen oxide emissions were determined at four different operating loads with the duct after-burners turned off and followed the guidelines of EPA Reference Method 7E using a continuous analyzer. During the NO_x testing oxygen readings were collected according to EPA Reference Method 3A in order to correct the NO_x results 15% O₂.

- **Comsip, New Jersey, New Jersey**

WWES conducted a Continuous Emission Monitor Certification study on the Nitrogen Oxide, Carbon Monoxide, and Oxygen continuous monitors at the University of Medicine and Dentistry of New Jersey Cogeneration facility. Comsip manufactured and installed the monitors at the facility and the testing was to show compliance with EPA performance Specifications 1, 2, and 3. WWES conducted a series of twelve 20-minute emission tests on the boiler exhaust using EPA Reference Methods 3A, 7E, and 10. Results from the WWES testing was compared to the corresponding plant data to show compliance for relative accuracy. A sampling protocol was prepared by WWES for approval by the New Jersey Department of Environmental Protection before the testing began.

AMBIENT MONITORING

- **Confidential, Midland, Michigan**

WWES developed an ambient air monitoring program for particulate and PM-10 at a Midland Facility. Upon assisting in the initial setup and calibration of sampling equipment, the facilities personnel are conducting all sampling with WWES supplying the laboratory analysis of the filters. Calculations of the final ambient concentrations are calculated and sent to the facility. WWES conducts routine maintenance on the samplers along with conducting quarterly audits.

- **Confidential, Ludington, Michigan**

WWES developed an ambient air monitoring program for a client near Ludington, Michigan. A sampling protocol was completed for Total Suspended Particulate/PM-10, Sulfur Dioxide (SO₂), and Nitrogen Oxides (NO_x). The sulfur dioxide and Nitrogen oxide continuous monitors were located in a conditioned trailer, while the TSP/PM-10 samplers were located on specially built platforms. The clients personnel are conducting the weekly routine operations on the monitors. WWES is conducting



the lab analysis on the TSP/PM-10 filters, quarterly audits on all sampling equipment, and preparing monthly reports.

- **Louisiana Pacific Corporation, Sagola, Michigan**

WWES developed and implemented an ambient air monitoring study at the Louisiana Pacific Sagola Wafer Board Plant. The purpose of the study was to develop sampling procedures, coordinate the selection of sampling sites, secure the appropriate sampling equipment on site, conduct the sampling according to the appropriate regulations and report the data to the Michigan Department of Natural Resources - Air Quality Division (MDNR,AQD).

WWES set-up two ambient monitoring stations to sample and monitor for Total Suspended Particulates, PM-10, Ozone, and Wind Speed/Wind Direction. Upon completion of the monitor set-up and initial calibration, plant personnel were trained in the daily routine sampling. Data from the TSP and PM-10 samplers were sent to the WWES laboratory for weight gain analysis, while data from the Ozone station was directly downloaded to an IBM computer at WWES's offices in Livonia through phone modem. Final reports, in the AIRS format, were sent to the MDNR for approval. Quarterly audits of all samplers were conducted by WWES personnel and approved by the MDNR.

- **Monitor Sugar Company, Bay City, Michigan**

WWES developed and implemented PM-10 air monitoring study at the Monitor Sugar plant in Bay City, Michigan. Three (3) sites were selected around the facility and the PM-10 monitors were sited according to the proper regulations. WWES trained the Monitor Sugar personnel as to the proper operating procedures so they could perform the weekly task of collecting and securing the filters. WWES receives the filters from each months sampling for analysis. Reports, in the AIRS format, are prepared each month and sent to the MDNR along with the precision and accuracy data each quarter.

WWES conducted a Volatile Organic Compound (VOC) ambient air study for a client around their waste transfer facility. Monitoring was conducted for inhalable particulate and approximately 25 volatile organic compounds. The purpose of the study was to determine whether the facility was contributing to the adverse ambient air around the facility. Monitoring was conducted at three sites, one upwind and two downwind for three different days during the summer. Inhalable particulate samples were collected using a cyclone with a filter attached and the VOC samples were collected using low flow pumps and Tenax sorbent tubes. Analysis of the particulate was conducted gravimetrically while the VOC samples were analyzed by GC/MS.



Professional Resources of WW Engineering & Science

Administrative & Clerical	90
Air Quality Specialists	17
Architects	8
Chemical/Process Engineers	11
Chemists	100
Civil Engineers	21
Community Relations Specialists	1
Construction Managers/Inspectors	16
Drafters/CAD	15
Computer Specialists	13
Ecologists	2
Electrical Engineers	7
Environmental Engineers	21
Environmental Scientists	30
Estimators	4
Field Technicians	15
Geological Engineers	5
Geologists	5
Geophysicists	5
Graphics Specialists	10
Hydrogeologists	43
Hydrologists	1
Mechanical Engineers	13
Planners (Urban/Regional)	4
Process Operations Specialists (WWOS)	98
QA/QC Specialists	7
Risk Assessment Specialists	5
Safety & Industrial Health Engineers	2
Structural Engineers	10
Surveyors	22
Transportation Engineers	3
June 1991 Total	604





Key Personnel

Dennis J. Gebben
President, Environmental Services Division

B.S. Geology, 1969
Grand Valley State Colleges

M.S. Geology, 1979
Western Michigan University

Mr. Gebben is President of our Environmental Services Division, a multidisciplinary environmental engineering group that offers a full range of environmental services primarily to industry and the private sector.

Prior to becoming President, Mr. Gebben was Director of the Geology Department. In that position he organized and developed an accomplished staff of geologists, hydrogeologists and geophysicists with proven expertise in hydrogeology and other geological disciplines.

Besides management, Mr. Gebben is experienced in work plan preparation, project budgeting, contract negotiations, and assuring the continued quality of project work. As a client manager, he continues to be responsible for maintaining good relationships with clients by soliciting feedback on the quality of our work.

Mr. Gebben's professional experience as a geologist began in 1972, focusing primarily on hydrogeology. He has extensive experience in ground water supply projects, site evaluations for land application of wastes from wastewater treatment facilities, ground water remediation projects, and hazardous waste facility siting and permitting. Major management responsibilities for Mr. Gebben began in 1981 with our expansion into a full-service environmental consulting firm. He has contributed significantly to our overall growth and development as a high quality, professional leader in the environmental consulting industry.

Mr. Gebben is a member of the Association of Ground Water Scientists and Engineers and is also active in community service as a commissioner for the Zeeland Board of Public Works.



Key Personnel

Richard R. Rediske, Ph.D.
President, WWES Environmental Laboratory Division

B.S. Biology and Chemistry, 1974
Bowling Green State University

M.S. Water Resources Sciences, 1975
University of Michigan

Ph.D. Environmental Health Sciences/Chemistry, 1986
University of Michigan

As President of the Environmental Laboratory Division of WW Engineering & Science, Dr. Rediske is responsible for the direction of a state of the art laboratory. With over 15 years of professional experience, Dr. Rediske brings to his role as president the specialized technical and managerial experience necessary to oversee the firms laboratory services division.

With a strong background in hazard evaluation and monitoring, environmental chemistry, toxicology, and analytical techniques, Dr. Rediske has directed numerous analytical service projects for industry and government involving the measurement and identification of hazardous chemicals in the environment. His area of specialization is trace organic analysis by GC/MS, GC, and HPLC. In addition, he has participated in projects involving the fate of chemicals in water and soil and their risks to human health and aquatic organisms. Dr. Rediske has also prepared safety plans and monitored site safety activities for many of our projects as well as developed in-house training programs.

Prior to joining our firm, Dr. Rediske was the Research Director for a large U.S. EPA study involving the fate of organic chemicals in the environment. He was also the organic chemistry director for a national group of laboratories.

Dr. Rediske has co-authored several articles published in scientific journals concerning the environmental fate of chemicals. He has also presented a number of technical seminars on environmental and analytical chemistry.

Dr. Rediske is a member of the following professional societies:

American Chemical Society
Water Pollution Control Federation
World Safety Organization
Sigma Xi

Dr. Rediske is also an Adjunct Professor of Chemistry at Grand Valley State University and teaches courses in Environmental and Industrial Chemistry.



Key Personnel

Ray Andrasi, P.E.

B.S. Geological Engineering, 1982
Michigan Technological University

Registered Professional Engineer - Michigan, Colorado

As a Project Manager with our firm, Mr. Andrasi is responsible for managing large multidisciplinary projects related to the investigation and remediation of sites of environmental impact. His management responsibilities require the use of his communication, budgeting and scheduling expertise to ensure the quality completion of projects to the client's satisfaction, and within regulatory guidelines. Project teams consisting of technically diverse personnel utilize existing as well as innovative technologies to achieve timely and economic completion of projects.

Currently, Mr. Andrasi is the project manager of two industrial projects in which the final phase of investigation is currently being undertaken, prior to formalizing remediation design. These industries employ different processes which are overseen by both state and federal regulatory agencies. Because of this, these projects require careful definition of work scope, and timely completion of remediation design to avoid potential conflict between the various agencies.

Mr. Andrasi's diverse background spans a period of eight years, performing geotechnical and environmental investigations in Colorado, New Mexico, east Texas, Arkansas, and Michigan. His recent history includes intensive environmental investigations varying from the permitting activities for hazardous and solid waste landfills, to performing impact assessment and remediation design at petroleum hydrocarbon release sites.

Prior to joining our firm, Mr. Andrasi relocated to metropolitan Detroit to open and manage a branch office of a Denver-based environmental firm. He successfully developed a client base, including four major petroleum retail and refining companies, while overseeing technical and administrative duties of thirty employees. The branch office eventually had approximately 100 active projects, and over 1.25 million dollars in sales per year. The majority of the projects involved assessment and remediation development for sites that had experienced a release from underground storage tanks. These sites were regulated under Michigan's Act 478 (Michigan Underground Storage Tank Act). Maintaining and complying with mandated reporting deadlines to assure (within his capabilities) the client's availability to Michigan Underground Storage Tank Financial Assurance (MUSTFA) funds was the major goal of his project management activities.



Key Personnel

Julie A. Beaton

B.S. Geology, 1977
Grand Valley State College

As Director of the Project Manager Group, Ms. Beaton is responsible for developing the firms project management techniques to enhance the efficiency and quality of our projects. She works closely with the other Group Directors and with the Facilities and Construction Management Division to ensure that all of our projects are run well. Ms. Beaton is also responsible for managing large multidisciplinary projects, including engineering for the design and construction of facilities used to implement remedial action programs and hydrogeological investigations for ground water and soil cleanup.

Since 1977, Ms. Beaton has been involved on a variety of projects for both industrial and governmental clients. These projects have included cleanup activities at industrial plant sites and train derailments. Ms. Beaton served as the Project Geologist for the 1982 ACEC award-winning cleanup of a chemical spill that occurred as a result of a train derailment. In addition, she has directed the installation of purge well systems for recovering contaminated ground water and directed the implementation of air stripping systems, aqueous and vapor carbon adsorption systems, and a vacuum-assisted steam stripping system for treating contaminated ground water.

Ms. Beaton has also worked as a field technician, geologist, project geologist, and study manager on a variety of public and private projects.

Ms. Beaton is a member of the following professional societies:

Association of Groundwater Scientists and Engineers
(a division of the National Water Well Association)



Key Personnel

William W. Beaton

B.S. Geography, 1977
Aquinas College

M.S. Atmospheric Science, 1979
University of Michigan

M.M. Management, 1990
Aquinas College

Mr. Beaton is responsible for managing, scheduling, and directing the daily activities of our Field Services Group. His responsibilities include scheduling, budgeting, training, and coordinating field sampling operations.

In addition to managing a staff of technical specialists, Mr. Beaton is actively involved in project management for a number of specialized field projects. His role in project management is to successfully complete the objectives of the work plan and insure client satisfaction with quality work. Mr. Beaton is experienced in site remediation projects, and he has managed tank sampling, excavation and removal activities connected with these projects. He is especially knowledgeable of the regulatory requirements with regard to the decontamination, transportation and disposal of PCB contaminated material.

Mr. Beaton is a participant in the health and safety training of WW Engineering & Science employees and subcontractors. He designed and implemented the health and safety program in response to OSHA regulations outlined in 29 CFR 1910.120. Mr. Beaton is currently an instructor and a primary reviewer of ESD safety plans in the firm's health and safety training program.

Prior to joining our firm in 1985, Mr. Beaton had six years experience as a project manager and environmental specialist for a major natural gas pipeline company. His responsibilities included hazardous waste management of the firm's field operations. He was involved in the remediation of sites, preparation of environmental permits, ambient air monitoring, and air quality dispersion modeling.

Mr. Beaton is a member of the following professional societies:

American Meteorological Society
Air/Waste Management Association



Key Personnel

R. Terry Begnoche

A.S. Science, 1978
Schoolcraft College

B.S. Environmental Science, 1981
University of Michigan

Advanced Management Studies, 1987
University of Michigan

Mr. Begnoche is responsible for managing and developing the full scope of Environmental Compliance Services in Southeast Michigan, including environmental audits and site assessments, RCRA/Act 64 permit services, environmental compliance strategy planning, problem resolution and wetlands evaluations.

Prior to joining our firm, Mr. Begnoche worked for eight years with one of the Midwest's largest hazardous waste management, transportation, and cleanup companies, where his positions included General Manager and Technical Director. Mr. Begnoche developed and authored employee safety and regulatory compliance manuals and conducted training sessions, provided regulatory guidance to the corporation, and managed emergency response actions, remedial projects, confined space entry activities, PCB cleanups, and decontamination projects. He has supervised cleanup activities pursuant to the Clean Water Act by the U.S. Coast Guard and by the U.S. EPA pursuant to CERCLA (Superfund), and by various state agencies.

Mr. Begnoche served as a volunteer to Waste Systems Institute's Small Quantity (Hazardous Waste) Generator Project Advisory Team during the project duration and provided several presentations to small-quantity generators as a project team member. He also served as a volunteer industry representative on Michigan's first Act 64 Citizens Information Committee formed to review a proposed hazardous waste incinerator in Oakland County.

Mr. Begnoche is a member of the following professional societies:

National Safety Council
Michigan Association of Environmental Professionals
President (current)



Key Personnel

Thomas M. Brunelle

B.S. Geology/Biology, 1980
University of Rochester

M.S. Geology/Geochemistry, 1984
University of Rochester

As the Assistant Director of the Geology Group, Mr. Brunelle is responsible for the overall supervision and day-to-day management of the group. His responsibilities include quality assurance and quality control of the Geological Services, which comprises 16 hydrogeologists, geophysicists and geologic engineers, and for comprehensive review of geological reports, proposals and work plans.

Mr. Brunelle has a wide range of expertise related to hydrogeological investigations and ground water remediation, with particular focus on geochemical interactions in ground water and soil regimes.

Mr. Brunelle's project experience has been with industrial and governmental clients. Much of this work has been related to the design and installation of ground water monitoring systems, the interpretation of geochemical data, and the design of effective soil and ground water remediation systems. Past projects that Mr. Brunelle has managed include ten major landfill sites in Michigan, five petroleum terminals and refineries, several municipal well contamination sites, coal gasification sites, and numerous sites related to industrial solvent and petroleum releases.

Prior to joining our firm, Mr. Brunelle was employed for five years as the Manager of the Hydrogeology Group at an environmental engineering firm in western Michigan. Before that time, he spent approximately one and a half years performing petroleum-related geochemical research with a grant from Texaco.

Mr. Brunelle is a member of the following professional societies:

- National Water Well Association - Association of Ground Water
Scientists and Engineers
- Soil Science Society of America
- American Society for Testing and Materials
- International Association on Water Pollution Research and Control
- American Geophysical Union - Hydrology Section
- Michigan Well Drillers Association - Ground Water Technology Division -
Vice President, 1990-1991



Key Personnel

Bruce H. Clarke

B.S. Civil Engineering, 1979
Michigan Technological University

M.S. Civil Engineering, 1981
Michigan Technological University

Registered Professional Engineer - Texas, Michigan

As a Project Manager for our firm, Mr. Clarke has responsibility for managing large multidisciplinary projects, providing other service areas with technical expertise, and responding to client concerns on project quality control, budget and schedule.

Mr. Clarke has directed a variety of solid and hazardous waste projects, industrial wastewater treatment projects, and CERCLA feasibility studies for industry groups. Key projects have included: CERCLA site treatability studies (sludge and soil biodegradation, stabilization, soil washing), RCRA Part B permit applications, Spill Prevention Control and Countermeasure Plans, hazardous waste facility closures, pilot studies for advanced treatment of industrial wastewaters and pilot biodegradability studies of PCB contaminated oily sludge, and pentachlorophenol contaminated soils. Mr. Clarke also has extensive experience in the field of petroleum refinery hazardous waste land treatment, including the design and conductance of land treatment demonstration projects.

Prior to joining our firm, Mr. Clarke was a project manager for a consulting engineering firm in Houston, Texas for two and one-half years, and prior to that was an environmental engineer with the corporate environmental compliance and environmental research groups of a major, international oil company.

Mr. Clarke is a member of the following professional societies:

Water Pollution Control Federation (WPCF)
American Society of Civil Engineers



Key Personnel

Mark J. Davidson

B.A. Biology, 1981
Luther College

M.A. Biology (Limnology), 1984
Mankato State University

As the Manager of Environmental Site Assessments, Mr. Davidson is responsible for marketing the group's services, proposal preparation, project management, scheduling, supervision of technical staff and technical quality assurance of projects. In addition to scheduling and conducting site assessment investigations, Mr. Davidson is also involved in facility audits for compliance with environmental regulations and preparation of NPDES permit applications. With a strong limnology background, Mr. Davidson offers technical support in the areas of water quality and wetlands investigations as well.

Prior to joining our firm, Mr. Davidson was an environmental specialist with the Iowa DNR where he gained regulatory compliance expertise in the following areas: industrial and municipal wastewater treatment, solid waste disposal, air quality, underground storage tanks, and emergency response. Mr. Davidson coordinated the Solid Waste Program and the Municipal Wastewater Treatment Improvement Program for the Southeast Iowa DNR Office.

As a limnologist with the University of Iowa Hygienic Laboratory, Mr. Davidson assisted in planning and conducting a variety of water quality studies of streams and lakes which included source-contamination and baseline monitoring studies for the Iowa DNR. Mr. Davidson coordinated contract environmental monitoring activities for a nuclear energy utility in eastern Iowa. Through these projects, Mr. Davidson became proficient in water quality and sediment sampling, stream-flow monitoring, automated sampling, and identification and enumeration of macroinvertebrate/benthos populations. He also worked as a pesticide chemist for the Hygienic Laboratory, a certified U. S. EPA-contract laboratory.

Mr. Davidson is a member of the following professional associations:

Michigan Association of Environmental Professionals
Federation of Environmental Technologists



Key Personnel

William T. Davidson

B.S. Geology, 1981
Hope College

M.S. Geology, 1986
Baylor University

As a senior project geologist, Mr. Davidson's responsibilities include the evaluation of hydrogeologic data, the design and implementation of monitoring well construction, and the preparation of hydrogeological reports. He has recently been involved in the geophysical exploration and evaluation of municipal ground water supplies. Mr. Davidson designs and manages ground water monitoring programs and prepares hydrogeological reports to meet the requirements of RCRA Part B permits, hazardous waste programs, sanitary landfill closures, and groundwater remediation systems.

Mr. Davidson has designed, coordinated and supervised a variety of field programs associated with hydrogeological investigations including soil boring and monitoring well construction; borehole geophysical studies involving gamma ray, resistivity and EM logging; surface resistivity; in-situ aquifer permeability analysis; and aquifer pumping test design and interpretation.

Prior to joining our firm Mr. Davidson was a logging engineer in Western Oklahoma and was assigned to monitor and evaluate various aspects of oil well drilling operations. This position included computer-based pressure evaluation profiles, hydrocarbon detection, and lithologic interpretation.

Mr. Davidson is a member of the National Water Well Association - Association of Ground Water Scientists and Engineers



Key Personnel

Scott T. Dennis

B.S. Geology, 1984
Wayne State University

M.S. Hydrogeology, 1987
Western Michigan University

Certified Professional Geologist - Indiana

Mr. Dennis is responsible for the overall management of the Geology Group, which is comprised of 16 hydrogeologists, geophysists, and geologic engineers. He is responsible for the quality assurance and quality control of Geological Services and for comprehensive review of geological reports, proposals, and work plans.

Mr. Dennis is an expert in ground water modeling and computer applications and is responsible for all quality assurance and quality control of computer modeling of ground water flow and contaminant transport at our firm. He also chairs our committee that is responsible for accelerating the use of personal computers in data acquisition, manipulation, and reporting, as well as for project management.

Mr. Dennis has conducted and managed numerous studies to evaluate ground water flow and contaminant transport. The results of these studies have been invaluable for designing effective remedial action programs and evaluating ground water flow regimes. His expertise with the use of computers integrated with his practical knowledge and experience has allowed for efficient, accurate, and cost-effective modeling studies and hydrogeologic investigations.

Mr. Dennis is a member of the following professional societies:

American Geophysical Union

National Water Well Association - Association of Ground Water Scientists
and Engineers

American Society for Testing and Materials (ASTM) - Active Member for Standards
Development on Subcommittees:

D-18.21.04: Determination of Hydrogeological Parameters

D-18.21.06: Monitoring Well Maintenance, Rehabilitation, and Abandonment

D-18.21.10: Ground Water Modeling



Key Personnel

John P. Dullaghan

Vice-President, Environmental Laboratory Division

- B.S. Chemistry, 1972
State University of New York, Plattsburgh
- M.S. Biochemistry, 1973
State University of New York, Plattsburgh
- M.B.A. Finance/Organizational Development, 1987
Marist College, Poughkeepsie, NY

The emphasis of Mr. Dullaghan's activities at our firm has centered around the development of a formal quality assurance and quality control program, including the development of standard operating procedures for quality control and laboratory management activities. Mr. Dullaghan's assistance in computerizing the QA/QC program contributed to our success in obtaining a contract as a State of Michigan "Superfund" laboratory under Act 307.

Mr. Dullaghan has also assisted in the development of the Quality Assurance Project Plans for remedial investigation and feasibility studies. These projects have involved the analysis of various sample matrices for the EPA Hazardous Substance List compounds. He has also directed analytical assessment testing programs for hazardous waste delisting petitions, groundwater monitoring programs, and waste characterization studies. His expertise in coordinating a project's technical and management requirements with site analysis needs assures that a legally defensible data package is delivered on time to meet program objectives.

Mr. Dullaghan's experience prior to joining our firm included the transformation of a small testing laboratory in New York into a substantial commercial testing facility serving large industries and the State of New York. The laboratory was certified by the New York State Department of Health for inorganic and organic analysis.

Mr. Dullaghan is a member of the following professional societies:

American Chemical Society
Water Pollution Control Association



Key Personnel

Betty M. Gajewski

B.S. Environmental Sciences with Honors
Grand Valley State College

Graduate Studies in Resource Development
Michigan State University

Because of her diverse expertise in various environmental fields, Ms. Gajewski assists with addressing the regulatory compliance, environmental assessment, and community planning requirements of different projects. Ms. Gajewski is familiar with the compliance requirements of environmental regulations, such as RCRA, CWA, CERCLA, SARA, OSHA, and various state laws. Her emphasis on integrating waste management and pollution prevention regulations into comprehensive environmental management programs has provided an efficient and practical approach to environmental compliance for various businesses.

Ms. Gajewski's experience has encompassed a wide range of environmental issues, from landfill siting to spill prevention plans. Specifically, she has assisted businesses in preparing waste management programs, emergency response plans, environmental compliance strategies, and permit applications. For communities, Ms. Gajewski has prepared solid waste management plans, completed recreation and other community planning studies, and provided community relations support on Superfund projects. As Manager of Environmental Management Services, she is responsible for training staff in the various environmental management programs and their requirements.

Prior to joining our firm, Ms. Gajewski was the Assistant to the Executive Director of a regional development commission with responsibilities that included project review and committee participation on environmental, community infrastructure, and economic development issues. As an environmental planner, Ms. Gajewski worked on projects involving stormwater management, land use, water quality issues, local ordinance review, shoreline studies, industrial retention, and grant applications. Ms. Gajewski has also chaired a solid waste planning committee.

Ms. Gajewski has written articles for a statewide newsletter on land and water issues and developed a statewide directory of organizations involved with water quality management. As an intern with a municipal environmental protection department, Ms. Gajewski handled citizen concerns on environmental ordinances as well as conducted waste management surveys that were presented to the city commission. Additionally, Ms. Gajewski was responsible for managing the Environmental Science Department laboratory. She was selected as Outstanding Environmental Science Senior by her department.

Ms. Gajewski is a member of the Michigan Society of Planning Officials and the Air and Waste Management Association.



Key Personnel

Celeste M. Greene

B.A. Geology, 1984
Ohio Wesleyan University

M.S. Geology, 1988
Ohio State University

Ms. Greene is responsible for maintaining the excellent quality of our environmental monitoring programs and for managing the environmental monitoring staff. The environmental monitoring staff oversees the scheduling, quality review, reporting and data management for all environmental monitoring programs. This team has been assembled to properly manage environmental monitoring programs and to provide innovative solutions for evolving monitoring requirements.

Ms. Greene has experience in designing, implementing, evaluating, and managing ground water monitoring programs for landfills, surface impoundments, drum storage areas and industrial facilities. She has been involved in over twenty-five ground water monitoring programs, and has written monitoring plans to satisfy RCRA and state hazardous waste regulations, to evaluate the ground water at existing industrial facilities, to monitor municipal well fields, and to track the progress of ground water clean-ups. Additional monitoring programs in which Ms. Greene has been involved include an extensive monitoring program for a chemical manufacturing facility, an aquifer monitoring program for the Island of Bermuda, and a monitoring program for a ground water clean-up involving five purge wells over a one-half mile long plume.

Ms. Greene graduated summa cum laude from Ohio Wesleyan, as a member of Phi Beta Kappa and was the recipient of the W. A. Tarr geology award. As a graduate student at Ohio State University, Ms. Greene was awarded a grant from ARCO Oil and Gas Company for her research on carbonate rocks in Nevada and operated, maintained, and provided training on the university's Scanning Electron Microscope (SEM). She also has over four years experience as a librarian including two years at Washington State University's Library.

Ms. Greene is a member of the Association of Ground Water Scientists and Engineers.



Key Personnel

Daniel G. Greene

B.S. Geology, 1984
Hope College

M.S. Geology, 1989
Ohio State University

As a project hydrogeologist, Mr. Greene is responsible for designing, implementing, and evaluating hydrogeologic investigations, and he serves as a team member on multidisciplinary projects.

Mr. Greene has a wide range of experience both as a hydrogeologist and as a geologist. He has extensive experience evaluating hydrogeologic, geographic, and temporal variations of glacial and glacial-related deposits in Michigan, Ohio and Antarctica. His responsibilities have included field sampling, supervision of monitoring well construction, geophysical logging, collection and interpretation of hydrogeologic data, and the preparation of hydrogeologic reports.

Mr. Greene has been involved in the exploration, evaluation, and protection of two major aquifers to determine their suitability for municipal water supply. He has designed monitoring programs to evaluate a variety of municipal and industrial sites and uses a variety of mathematical, geophysical, and geochemical techniques to determine hydraulic characteristics of geologic materials.



Key Personnel

Lawrence M. Hands

B.A. Chemistry, 1974
Syracuse University

B.S. Environmental Engineering, 1974
Syracuse University

M.S.E. Mechanical Engineering, 1983
University of Michigan

Registered Professional Engineer - Michigan

As Project Manager of Air Licensing Services, Mr. Hands directs projects relating to local, state and federal air quality regulations and solid waste issues.

Mr. Hands has significant experience in air quality permitting and engineering, having been instrumental in the permitting and design of a number of large waste-to-energy projects across the United States. He has prepared permit applications resulting in successfully obtaining PSD and solid waste facility permits, air pollution equipment registrations and other environmental and construction-related permits. He has also assisted his clients in obtaining permits in non-attainment areas and has addressed non-criteria pollutant and risk assessment issues.

Mr. Hands is intimately familiar with current technology for air pollution control and monitoring, having specified and reviewed engineering for dry and semi-dry scrubbers, lime preparation facilities, fabric filter technology, thermal deNO_x installations and continuous stack emission monitors with data acquisition and reporting packages. In addition, he has evaluated fume incinerators, activated carbon adsorption towers, steel mill emission controls, cement dust control and many other types of air quality control installations.

Mr. Hands is a member of the following professional societies:

Air and Waste Management Association
American Society of Mechanical Engineers
Engineering Society of Detroit
Society for Environmental Science



Key Personnel

Glenn A. Hendrix

B.S. Zoology and Limnology, 1977 (with honor)
Michigan State University

M.S. Biological Sciences (Aquatic Ecology), 1983 (with honor)
Michigan Technological University

Mr. Hendrix serves as a Senior Environmental Scientist/Limnologist. He assists clients with permitting requirements and compliance with environmental regulations. He conducts environmental studies for industry, government, and business, including environmental assessments, risk assessments, environmental fate and effects of toxic substances, limnological investigations, wetland studies and water quality studies.

Mr. Hendrix has completed a variety of environmental projects. These projects include: risk assessments; environmental assessments; hazardous waste facility permits; Remedial Investigations/Feasibility Studies; limnological investigations; water quality studies; and wetland identification, permitting, and mitigation.

Prior to joining our firm, Mr. Hendrix worked on a large rural non-point source pollution study sponsored by the U.S. EPA and developed a system for identifying critical areas that are non-point sources of pollutants in Michigan. He has conducted limnological and biological surveys of Lake Michigan, Lake Superior, inland lakes, and streams. He also coordinated a U.S. EPA-sponsored study of toxic contaminants in a large river system, including sampling, data analysis, modeling, and technical review.

Mr. Hendrix has written a number of articles and reports on the fate of toxic chemicals in aquatic environments, water quality, non-point source pollution, small quantities of hazardous wastes, and environmental assessment. He has completed training by the Environmental Protection Agency on wetland delineation and jurisdiction and Health and Safety Training for Hazardous Waste Operations and Emergency Response.

Mr. Hendrix is a member of the following professional societies:

National Association of Environmental Professionals
International Association for Great Lakes Research
American Society of Limnology and Oceanography
North American Lake Management Society
American Water Resources Association
Association of Wetland Managers



Key Personnel

Timothy K. Henning

B.S. Environmental Engineering
Purdue University, 1982

Engineer-in-Training - Indiana

Mr. Henning has managed a number of underground storage tank related projects, including numerous site assessments of underground storage tank facilities and tank removal and soil remediation projects. His experience includes design of petroleum and chemical storage tank systems to comply with regulatory requirements, including fluid handling systems, inventory control and leak detection systems, secondary containment systems, and tank monitoring program design.

He has been a resident engineer for construction of new underground tank systems. His responsibilities included review of contractor submittals, supervision of construction contractors, construction project scheduling, inspection and cost control, and tank system performance testing.

Mr. Henning's experience includes conducting Phase I environmental assessments for over \$100 million in property transfers.

With a previous employer, Mr. Henning managed several projects in support of a nationwide contract with the U.S. EPA for investigating and remediating hazardous waste sites. As part of this contract, he managed a remedial design project for a 3.1 MGD granular activated carbon water treatment plant for a Minnesota community whose entire ground water supply has been contaminated with volatile organic compounds. Start-up of the plant occurred in December 1990.

Mr. Henning has also served as project engineer for several design projects for municipal water supply improvements, including a 1,000-foot deep municipal well, 1.5 MGD pumping station and water main.

Mr. Henning is a member of the American Society of Civil Engineers.



Key Personnel

Theodore A. Lietzke

B.S. Chemistry, 1971 (with honor)
Adrian College

M.S. Geological Sciences, 1979
Northwestern University

As a Project Manager with our firm, Mr. Lietzke is responsible for managing large multidisciplinary projects, including hydrogeological investigations for ground water and soil cleanup, and engineering for the design and implementation of remediation programs.

Mr. Lietzke has managed a variety of projects for both industrial and governmental clients. These projects have included engineering studies of a plant waste treatment system to implement a ground water treatment program using the existing facilities and engineering for remedial action plans using air stripping technology for ground water treatment.

Mr. Lietzke has been involved in the design and implementation of soil vapor investigations and a soil vapor monitoring program for underground storage tanks. Mr. Lietzke has been involved in the design and installation of soil vapor recovery systems for soil remediation and has developed methods for evaluation of sites for soil vapor recovery.

Mr. Lietzke has overseen projects which encompass all phases of underground tank management, including tank testing, tank release determinations, tank remediation, regulatory compliance, and other issues.

Prior to this work at our firm, Mr. Lietzke managed a variety of hydrogeological investigation projects for both industrial and governmental clients. These include hazardous waste facility permitting, industrial site evaluations of soils and groundwater, and remedial investigation and feasibility studies at former waste disposal sites. Some of the industrial site evaluations have been part of multidisciplinary projects to determine the extent of soil and groundwater contamination, design remedial responses, and modify plant practices and processes to prevent further contamination.

Mr. Lietzke has a background in contaminant transport mechanisms in soils and water. In addition, he has experience in geophysical methods for determining lithological conditions and contamination.

Mr. Lietzke is a member of the following professional societies:

- American Chemical Society
- Association of Groundwater Scientists and Engineers (NWWA)
- Sigma Xi
- American Geophysical Union
- American Association for the Advancement of Science



Key Personnel

Mary Ellen Mika

B.S. Biochemistry, 1984
Michigan State University

Ms. Mika is Licensing Manager in Air Quality Services. She manages a staff of technical professionals who are involved in a wide range of air quality licensing activities, from the preparation of state-required air use permit applications and compliance audits to federal Prevention of Significant Deterioration (PSD) permit applications including five-year dispersion modeling studies, Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) analyses. Ms. Mika is responsible for quality assurance of all licensing work as well as the training of entry level staff.

Her project experience includes conducting dispersion modeling analyses and preparing air use permit applications which have resulted in approved permits for large coal and oil-fired cogeneration units; natural gas-fired as well as landfill gas-fired turbines; contaminated soil and groundwater treatment systems such as soil vacuum systems, air strippers and aeration systems; hospital waste incinerators; rotary lime kilns and pulp dryers; and permit modifications for proposed fuel changes, stack and breeching modifications.

Prior to her involvement with Air Quality Services, Ms. Mika worked in both the Environmental Compliance Group and Environmental Laboratory Division of WW Engineering & Science. In the Environmental Compliance Group, she was involved with projects related to hazardous waste and water resource regulations which included federal Spill Prevention Countermeasure and Control (SPCC) plans, state Pollution Incident Prevention (PIP) plans, hazardous waste Emergency Response and Contingency Plans, and asbestos and PCB abatement/removal plans. In the Environmental Laboratory Division, Ms. Mika conducted gas chromatograph/mass spectral analyses of soil and water samples for volatile, acid, PCB, and base-neutral organic parameters.

Ms. Mika is a member of the following professional societies:

- Air and Waste Management Association (AWMA)
- American Chemical Society (ACS)
- Federation of Environmental Technologists (FET)



Key Personnel

Mark J. Mullen

B.S. Environmental Studies, 1982
University of Michigan

As Manager of Air Quality Services, Southeast Michigan Office, Mr. Mullen is responsible for consulting services, marketing, and project management relating to all air quality environmental projects at this branch.

Prior to joining our firm, Mr. Mullen served for six years with an environmental consulting firm in the Detroit area where he attained the level of Department Director, Ambient Air and Air Emissions. In this position, Mr. Mullen was responsible for marketing, scheduling, technical review of air related projects, and source and ambient testing.

During his six years of service in the air quality field, Mr. Mullen has developed a thorough knowledge of federal and state source testing methods. He has developed and directed air quality projects involving VOC destruction efficiencies on incinerators at coating facilities, hazardous waste trial burns on various incinerators, toxic emission studies at chemical plants, particulate studies on boiler exhausts, automotive spraybooth acceptance tests, odor evaluations, PSD monitoring around major emission sources, ambient particulate fall-out studies for corrosive material and TSD ambient monitoring for organics and metals. In addition, Mr. Mullen has prepared source sampling QA/QC protocols, ambient air monitoring protocols, and air use permits for particulate and organic emissions.

Mr. Mullen is a member of the following professional societies:

Air and Waste Management Association (AWMA)
Source Evaluation Society (SES)



Key Personnel

Kevin A. Payler

A.S. Environmental Quality Control, 1979
Muskingum Area Technical College
Zanesville, Ohio

As Manager of Air Quality Sampling, Mr. Payler assumes responsibility for air sampling and monitoring on projects relating to air quality environmental review. He has eight years of experience in this field.

Mr. Payler has developed a thorough knowledge of air sampling methods and requirements. He has developed a thorough understanding of many industrial processes and their associated air emission control devices. He has developed sampling strategies for specific pollutants and custom designed sampling equipment for these pollutants.

Representative Project Experience

- **Dayton, Ohio.** Performed Method 25 VOC test on an offset press and a VOC destruction efficiency on the thermal oxidizer for compliance determination.
- **Toledo, Ohio.** Performed a VOC capture and removal efficiency test on nine (9) vinyl print and finish machines and the associated carbon adsorber using Reference Methods 25 and 25A.
- **Decatur, Alabama.** Performed a trial burn test on a boiler fired with waste derived fuel. Tests included Particulate and Volatile Organic Sampling Train (VOST).
- **Camarillo, California.** Conducted a fugitive emission study on a magnetic media production plant. Sampling was conducted using Reference Method 25A and 18; sampling occurred continuously over three 24-hour periods.
- **Circleville, Ohio.** Conducted emission tests for specific volatile organic compounds using Reference Method 18 at a florescent light tube manufacturer.
- **Vandalia, Ohio.** Sampled for cyclohexane emissions at a pharmaceutical manufacturer, using Reference Method 18.
- **Dayton, Ohio.** Sampled for particulate NO_x, SO₂ emissions on a coal fired industrial boiler.
- **Boston, Massachusetts.** Sampled for ozone emissions from an electron beam vault.



Key Personnel

Kevin A. Payler (Cont'd)

- **Houston, Texas.** Sampled printing press and catalytic incinerator for VOC, CO and NO_x emissions.
- **Circleville, Ohio.** Performed particulate and lead emissions from a glass smelter.
- **Portsmouth, Ohio.** Performed particulate compliance test on an 18 module bag house serving foundry cupola.
- **Dayton, Ohio.** Performed total particulate and particle size distribution on a plastics cutting operation.
- **Connersville, Indiana.** Performed chromium emissions and particle size distribution at a automotive parts manufacturer.

Mr. Payler is a member of the following professional society:

Air and Waste Management Association (AWMA)



Key Personnel

Robert W. Phillips
Vice President, Environmental Services Division

- B.S. Natural Resources Planning and Conservation, 1969
Central Michigan University
- B.S. Wildlife Management, 1970
University of Michigan
- M.S. Resources Planning and Conservation, 1972
University of Michigan

As Vice President of the Environmental Services Division and Director of the ARCS Program Management Office, Mr Phillips is responsible for directing a corporate-wide, multi-million dollar, ten year, U. S. Environmental Protection Agency contract to perform remedial planning activities in Region V (OH, MI, IN, IL, WI, MN). This WW Engineering & Science contract consists of two functional parts, Program Management and Remedial Planning. Program Management is provided on a completion basis for the term of the contract and encompasses management, financial, administrative and clerical functions necessary to support and track contract project performance. Remedial Planning is provided on a Level of Effort (LOE) basis with all work being assigned through EPA issuance of work assignments. Mr. Phillips is responsible for directing the overall program through the ARCS Program Management Office (PMO). He has direct control and oversees all PMO personnel and technical staff performance, work task assignments, scheduling and budget preparation, cost control and tracking and communication between our firm and the U. S. EPA.

Mr. Phillips has been active on a variety of projects requiring environmental and human health impact and risk assessments. He has performed many field investigations and impact assessments involving on-site contamination at former coal gasification facilities. Mr. Phillips has also been responsible for undertaking environmental and human health risk assessments related to air emissions, surface and groundwater contamination, and terrestrial pollution incidents. In addition, he has prepared environmental impact assessments for an airport expansion, for the replacement of a historical bridge, and for the siting of industrial facilities. He has helped prepare and implement work plans for remedial investigations and feasibility studies for contaminated sites identified by state or federal priority lists. He has also managed various wetlands determination inventories and has prepared the associated wetland permit applications and mitigation plans for various industrial clients.



Key Personnel

Robert W. Phillips (Cont'd)

Prior to joining our firm, Mr. Phillips had over 12 years of professional experience in project development, management, and administration in the U.S., Canada, the Caribbean, and Middle East. He has worked on projects involving impact assessments for oil and natural gas development and transportation, critical features analysis for coal slurry pipelines, nationwide oil and hazardous materials emergency response, Superfund site remedial activities, industrial facility siting, surface water impact analysis and mitigation plan development, erosion control and reclamation programs, land use and recreational development, cultural resources inventories, endangered species surveys, environmental compliance monitoring activities for construction projects, and health and safety protocol development.

Mr. Phillips is a member of the following professional societies:

Wildlife Society

Michigan Association of Environmental Professionals



Key Personnel

Lucy B. Pugh

B.S. Environmental Sciences Engineering, 1980
University of Michigan

M.S. Civil Engineering, 1981
University of Michigan

Registered Professional Engineer - Michigan

The focus of the Engineering Group is on process selection and evaluation, as well as treatability and pilot testing for various environmental projects. As Director of Engineering, Ms. Pugh is responsible for scheduling and managing projects within the Engineering Group encompassing all phases of engineering from evaluations and studies to full-scale process design. She also serves as a project team member on multidisciplinary projects.

Ms. Pugh has been involved in a variety of projects for both industries and municipalities. Her participation in RCRA and CERCLA studies for the U.S. EPA and industry has included evaluation of a range of demonstrated and innovative technologies for ground water, soils, and solid/hazardous wastes. She has conducted feasibility, treatability and full-scale studies and design of water, wastewater, and hazardous waste treatment processes, including treatment of contaminated soils, sludges and ground water. Ms. Pugh has also been involved in projects dealing with waste minimization, and both aerobic and anaerobic biological treatment.

Ms. Pugh has published and presented a number of technical papers at the Purdue Industrial Waste Conference and the Annual Conferences of WPCF and AWWA. Subjects include treatment of industrial and municipal wastewaters and contaminated ground waters, measurement of biomass activity and microbial contamination, and biological nutrient removal.

Ms. Pugh is a member of the following professional societies:

Water Pollution Control Federation
American Society of Civil Engineers
Michigan Section Scholarship Chairperson, 1987-1990
Michigan Society of Professional Engineers
National Society of Professional Engineers

She has received the following honors and awards:

Young Engineer of the Year, 1987, Ann Arbor Chapter,
Michigan Society of Professional Engineers
James R. Rumsey Award, 1987 and 1990, Michigan Water Pollution Control Association



Key Personnel

Allen J. Reilly, Jr.

B.A. Biology, 1983
Carleton College

M.E.S. Environmental Sciences, 1989
Yale University

As Manager of Environmental Risk Assessment Services, Mr. Reilly assists clients in the design and implementation of innovative compliance strategies for a wide range of state and federal environmental regulations. He specializes in developing remedial cleanup programs for contaminated sites and has done so for a number of major manufacturing companies. Mr. Reilly evaluates various cleanup strategies and cleanup standards in light of projected cleanup costs, possible land uses, and potential regulatory ramifications. Using his training in both scientific and regulatory matters, Mr. Reilly is adept at reconciling the quantitative with the legal aspects of environmental risk assessment. He also works effectively with various regulatory agencies on behalf of WWES clients.

Mr. Reilly's curriculum at Yale was interdisciplinary in nature. His course work included environmental law, natural resource policy and management, natural resource law, risk and regulation as well as soil science, hydrology, and ecology. He possesses a strong background in laboratory/field research, having spent time at the Woods Hole Oceanographic Institution researching the effect of heavy metals on plankton.

While a student, he was awarded a Fellowship by the Environmental Protection Agency to analyze policy at the Office of Marine and Estuarine Protection in Washington, D.C. As a policy analyst at the EPA, he wrote technical guidances and policy statements on such diverse issues as the management of toxics in combined sewer overflow, the feasibility of requiring ambient monitoring as part of all NPDES permits, and the impact of toxics and floatables on nearcoast marine processes. He also participated in several work groups responsible for revising draft regulations on the NPDES permitting program for municipal storm sewers and for a combined sewer overflow abatement strategy. In addition to his work with the EPA, Mr. Reilly conducted site visits for the Office of Technology Assessment in preparation for its report to Congress on the reauthorization of RCRA.



Key Personnel

William A. Stough

B.S. Urban and Environmental Planning, 1977
Grand Valley State University

M.M. Master of Management, 1988
Aquinas College

Mr. Stough is responsible for the overall management of the Environmental Compliance Group. In this capacity, his work includes marketing, staff planning and development, quality assurance, and project management.

Mr. Stough has 12 years of experience in environmental management which includes work in both the public and private sectors. He has demonstrated proficiency in researching and writing grant proposals and in managing solid and hazardous waste projects funded by the U.S. EPA, state regulatory agencies and private foundations. In addition, he has been a project manager on RCRA corrective action investigations at Solid Waste Management Units, on Phase I Environmental Site Assessments and Phase II Site Investigations for real estate transactions. Mr. Stough has developed special expertise in environmental regulatory analyses, waste reduction and minimization strategies, environmental communications and public relations planning, and as a skilled researcher and negotiator of environmental compliance issues.

Prior to joining our firm, Mr. Stough served six years as a Technical Project Manager and eventually as Assistant Director of Waste Systems Institute of Michigan. He was responsible for organizing and directing their technical assistance programs, managing the Great Lakes Waste Exchange information clearinghouse, and writing and editing the *Great Lakes Exchange* technical magazine. Mr. Stough is currently Chairman of the Grand Rapids Area Chamber of Commerce Environmental Affairs Committee, is a member of the Board of Directors of the Michigan Association of Environmental Professionals, and recently served on the Michigan Environmental Technology Board.

Mr. Stough is a member of the following professional societies:

Federation of Environmental Technologists
Michigan Association of Environmental Professionals
National Association of Environmental Professionals



Key Personnel

D. Eric Strang
Vice President, Environmental Services Division

B.S. Civil Engineering, 1975
Major in Environmental Engineering & Hydraulics
Michigan Technological University

Registered Professional Engineer - Michigan

As Director of the Remedial Technologies Group of our Environmental Services Division, Mr. Strang is responsible for developing and keeping current on remediation technologies, assisting in development of project management skills, and developing and implementing annual group goals. He also acts as a Project Manager with our firm, and therefore is responsible for directing activities of a multidisciplinary project staff that supports our comprehensive assignments. He assigns project staff members to various tasks and supervises and reviews their technical work. His responsibilities also include managing large multidisciplinary projects, such as hydrogeological investigations for ground water cleanup projects and other remedial action programs, project organization and budget management.

Mr. Strang has been involved in environmental engineering projects conducted for both the public and private sectors. These projects have included all aspects of the U.S. EPA "201" water pollution control facility planning process as well as detailed design of industrial and municipal wastewater collection and treatment systems. He has also demonstrated considerable experience and expertise in the planning and execution of multidisciplinary hazardous waste management and remedial action projects.

During a sabbatical leave, Mr. Strang worked overseas for a Japanese consulting firm as a project coordinator for large civil engineering projects undertaken for various U.S. military bases. Mr. Strang was also a project team member involved in the Final Clarifier Modification Project, winner of the 1980 Grand Conceptor Award for Engineering Excellence by the American Consulting Engineers Council.

Mr. Strang is a member of the following professional societies:

- Water Pollution Control Federation
- American Society of Civil Engineers



Key Personnel

Jeffrey C. Sutherland

A.B. Geology, 1962
Cornell University

Ph.D. Geology, 1968
Syracuse University

Registered Professional Engineer - Michigan
Certified Professional Geologist, AIPG
Diplomat, American Academy of Environmental Engineers

As Director of Quality Assurance and Health & Safety, Dr. Sutherland is responsible for developing and implementing quality control and quality assurance procedures for our firm and ensuring that the necessary systems are in place to train staff in quality assurance procedures and that the necessary mechanisms for quality assurance are being followed. Dr. Sutherland also supervises a staff of 15 hydrogeologists and geophysicists. He serves as a manager of hydrogeology and multidisciplinary projects, and as a technical resource for hydrogeology and land application of municipal wastewater.

Dr. Sutherland has managed numerous hydrogeological and interdisciplinary projects for ground water development, ground water cleanup, treatment of municipal wastewater through land application (upland, overland flow, wetlands), and hazardous waste site investigation. He has conducted research and published numerous articles on the technical and economic factors related to land application of municipal wastewater.

He is a member of the following professional societies:

American Institute of Professional Geologists
Association of Ground Water Scientists and Engineers (NWMA)
National Society of Professional Engineers
American Academy of Environmental Engineers
American Association for the Advancement of Science



Key Personnel

Samuel S. Tawney

B.S. Chemical Engineering, 1984
Michigan Technological University

Professional Engineer - Michigan, Kentucky

As a project manager in our firm's Remedial Technologies Group, Mr. Tawney is responsible for managing projects for industrial clients. His responsibilities include budgeting, proposal preparation, project planning and project tracking. He has participated in the design and construction of specialized treatment systems to treat ground water and soils contaminated with various toxic substances and industrial wastes. His responsibilities have included preliminary and final design, mechanical layout, purchasing, writing specifications for process equipment, and writing contract specifications.

Mr. Tawney has had experience in a wide variety of industries, including chemical and pharmaceutical manufacturing plants, metal finishing plants, natural gas compressor stations, automotive manufacturers, and chemical distributors. Mr. Tawney has also been active in the design and construction of air and steam stripping technologies for ground water and wastewater treatment and has developed specialized computer algorithms for effective evaluation of key design and scale-up parameters. Other projects have included the evaluation of evaporation for treatment of industrial wastewater, evaluation of a steam distillation system for treatment of ground water and design of a metals treatment wastewater facility.

Mr. Tawney is a member of the following professional societies:

American Institute of Chemical Engineers
American Institute of Chemical Engineers, Environmental Division



Key Personnel

James N. Tolbert

B.S. Geology, 1982
Michigan State University

M.S. Geology, 1985
Michigan State University

Mr. Tolbert assists in the management of the Environmental Compliance Group. His responsibilities include staff development and management, quality assurance, marketing new services development for compliance services, and project management on selected projects.

Mr. Tolbert has extensive experience designing, implementing, and managing monitoring programs for landfills, surface impoundments, waste piles, drum storage areas, and existing and new industrial facilities, both during the active life of the facility and during post-closure activities. Mr. Tolbert has been involved in multidisciplinary teams to address numerous environmental issues including hazardous and solid waste disposal issues, risk based evaluations of cleanup levels, permitting issues, and facility closures.

Mr. Tolbert has established environmental monitoring programs to meet the requirements of RCRA Part B permits, state solid and hazardous waste programs, and ground water discharge permits. He has also set up monitoring programs to evaluate existing ground water contamination, to track ground water clean-up operations, and to determine background ground water quality.

In addition to his involvement in permitting and monitoring, Mr. Tolbert has conducted numerous hydrogeologic investigations, including studies to evaluate the extent of historical brine contamination, to delineate and remediate ground water contaminated with chlorinated solvents, to develop a petition for alternate concentration limits (ACL's) under RCRA, and to evaluate the effectiveness of a site containment strategy for ground water at a major chemical facility.

Mr. Tolbert is a member of the following professional societies:

American Management Association
Association of Ground Water Scientists and Engineers
Michigan Association of Environmental Professionals



Key Personnel

Elizabeth M. Uhl

B.S. Geosciences, 1982
University of Arizona

M.S. Geology, expected 1990
Southern Illinois University

As a Senior Project Hydrogeologist, Ms. Uhl is responsible for managing ground water monitoring systems, designing and implementing geologic and hydrogeologic investigations, and serves as a project team member on multidisciplinary projects.

Ms. Uhl has been involved with hydrogeological and geophysical investigations for numerous private and governmental facilities. Hydrogeologic studies have provided her with experience in the assessment of organic and inorganic ground water and soil contamination, monitoring well network design, site characterization of uncontrolled hazardous waste sites, and environmental sampling of ground water, surface water, soil, and sediment. Ms. Uhl has performed field work on sites with the following geophysical equipment; Ground Penetrating Radar, EM-34, Fluxgate and Proton Precession Magnetometers, and Seismic Refraction Units.

Ms. Uhl has been involved with the RI/FS process under the U.S. EPA ARCS and REM II contracts and under an Illinois EPA contract. Her work on these programs has included experience in project plan preparation, supervision of RI field work, analysis of the data results, and report preparation. Ms. Uhl has written and budgeted Work Plans, Sampling Plans, and Quality Assurance Project Plans for large scale Remedial Investigations for Region V, U.S. EPA. Her work has also included review of Project Plans written by other consultants for Potentially Responsible Party RI/FS's.

Additional work includes preparation of ground water sections for Act 64 and Part B permits and participation in environmental site assessments.

Ms. Uhl's Master's thesis involved a geophysical study to delineate the extent of a buried bedrock valley.

Ms. Uhl is affiliated with the following professional societies:

National Water Well Association
Geological Society of America



Key Personnel

Susan J. Vanderploeg
Vice President

B.S. Chemistry and Biology, 1979
Calvin College

M.M. Management, 1988
Aquinas College

As Director of Marketing for the Environmental Services Division, Ms. Vanderploeg oversees all marketing activities for the division. She also works closely with members of the other WWES divisions and branch offices in business development activities. Prior to becoming the Director of Marketing, Ms. Vanderploeg was responsible for the management of the Environmental Compliance Group. In this capacity, her work included marketing, staff planning and development, quality assurance, general administrative activities, and some project management.

Ms. Vanderploeg has developed considerable experience in project management for specific environmental compliance work and for our broader multidisciplinary projects. She has worked extensively with a variety of industries and is very familiar with in-plant processes and their environmental compliance requirements under various federal and state regulations affecting air and water quality and hazardous waste management. She has managed remedial investigations and cleanup activities at industrial sites and for responsible parties at CERCLA sites. Ms. Vanderploeg is also skilled in maintaining successful client relationships and in working with clients and their project staff to assure that the project's objectives are effectively satisfied.

When Ms. Vanderploeg joined the company in 1981, she worked as an organic analytical chemist for our laboratory.

Ms. Vanderploeg is a member of the Grand Rapids Chamber of Commerce Environmental Affairs Committee and the following professional societies:

National Association of Environmental Professionals
Michigan Association of Environmental Professionals
Water Pollution Control Federation



Key Personnel

James G. Venn

B.S. Geology, 1972
Albion College

M.S. Geological Engineering, 1977
University of Missouri-Rolla

As a Project Manager with the Environmental Services Division, Mr. Venn is responsible for managing projects dealing with ground water contamination studies, environmental and regulatory studies, and site remediation projects. Management of these projects includes supervision of a large number of scientists, engineers, and field personnel.

Mr. Venn has directed a wide variety of field investigations for both industrial and governmental clients. These projects have included spill sites, industrial plant areas, and landfills and have involved the investigation and cleanup of both soil and ground water contamination in Michigan, Wisconsin, and Illinois.

During the last two years, Mr. Venn has supervised six field investigations at four former manufactured gas sites in Wisconsin, for three utility companies. The projects were initiated with the submittal of work plans for investigation and remediation of soil and ground water contamination caused by coal tars and sludges. Mr. Venn supervised the field work, submitted the appropriate reports and coordinated client contact. The coal tar investigations also included meetings with the Department of Natural Resources for regulatory concurrence and approval. Mr. Venn has also supervised a field remediation that concluded with the excavation and disposal of approximately 4,500 cubic yards of coal tars and coal tar impacted soils.

Mr. Venn's most recent large scale project involved management of a subsurface investigation and engineering design for a perimeter drain and clay cap to contain residual ground water contamination at a Chrysler Corporation plant site in Detroit, Michigan.

Prior to joining our firm, Mr. Venn was employed for eight years in the petroleum industry with responsibility for oil and gas exploration and development efforts in the western and southwestern United States. These responsibilities included submittal of numerous drilling prospects with supporting economics. The drilling of the geological prospects resulted in a substantial addition of commercial reserves of oil and gas for three petroleum companies.

Mr. Venn is a member of the following professional societies:

National Water Well Association
American Association of Petroleum Geologists



Key Personnel

Albert R. Webb

- B.S. Chemistry, 1973 (with honors)
Central Michigan University
- J.D. University of Detroit School of Law, 1979
- M.P.H. Industrial Hygiene/Safety, 1986 (with honors)
University of Michigan, School of Public Health

As Senior Project Scientist within the Environmental Compliance Group, Mr. Webb serves as a project team member on multidisciplinary projects assuring that the health and safety plans for all projects are in agreement with state and federal regulations. He also assists clients with occupational health and safety and environmental regulatory compliance matters.

Mr. Webb has worked on numerous projects for industrial clients involving the determination and fulfillment of their obligations for compliance under both the Emergency Response/Community Right-to-Know (SARA Title III), and Worker Right-to-Know regulations. He has also conducted Environmental Site Assessments of various properties related to real estate transactions.

In addition to his position within the Environmental Compliance Group, Mr. Webb serves as Occupational Health and Safety Officer and is a member of the Corporate Safety Committee. In this role he develops and reviews company safety goals and objectives; evaluates safety programs for accomplishing those objectives; organizes and coordinates health and safety training programs; supervises medical monitoring; and develops and/or approves site health and safety plans for hazardous waste site investigations, and related field activities.

Prior to joining our firm, Mr. Webb had over three years of experience as a Field Engineer and safety officer for an oil and gas exploration service company, and over six years of experience with environmental and industrial hygiene consulting firms. His work experience includes the performance of comprehensive industrial hygiene surveys in a variety of industrial settings, and the supervision of employees' safe and efficient work activities under potentially hazardous work conditions.

Mr. Webb is a member of the following professional associations:

American Industrial Hygiene Association
American Public Health Association
American Chemical Society
National Safety Council



Key Personnel

Michael T. Williams, P.E.

B.S. Civil Engineering, 1976
Michigan Technological University

Registered Professional Engineer - Michigan, New Mexico, Indiana

Mr. Williams is currently serving with this three member group of engineers specializing in large, innovative remediation projects and the development and implementation of new remediation technology. Mr. Williams is presently developing *in situ* biological treatment technology, certain specialized solidification technology and an oxidation process for which a U.S. patent is being applied.

Mr. Williams served as Construction Services Manager for 4 years. His duties included assignment of construction management personnel, supervision, and quality assurance of construction activities on all remediation projects. Mr. Williams was also responsible for in-house quality assurance on specification integrity and design constructability. He has directed numerous projects involving the construction and operation of specialized facilities for environmental control and remedial action.

Mr. Williams has also acted as design engineer, project engineer and resident engineer on numerous municipal wastewater collection and treatment projects and on industrial remediation projects. Prior to joining our firm, he had seven years experience in construction contracting.

Mr. Williams is a member of the following professional societies:

American Society of Civil Engineers
National Society of Professional Engineers
Construction Specification Institute



Key Personnel

Stephen J. Young
Vice President

As Director of our Field Services Group which includes Tank Management Services, Mr. Young manages and directs investigations involving hazardous and toxic materials, drilling operations, and sampling programs. He also serves as a coordinator and member of emergency response teams for spills of hazardous or toxic materials. His additional responsibilities include the management of wastewater flow recording, sampling, and project monitoring activities for industrial clients.

Mr. Young joined our Environmental Services Division after more than 18 years with our Governmental Services Division. During those 18 years, he supervised the materials testing laboratory and assumed responsibility for industrial and municipal clients in regard to their wastewater flow recording, sampling, and project monitoring needs. In addition, Mr. Young has completed several related seminars and intensive training courses at the University of Wisconsin.

Mr. Young is a member of the following professional organizations:

Certified Engineering Technicians
American Society of Civil Engineers

Publications:

Wallace, D.A. and S.J. Young, "The Cleanup of a Styrene Spill." Proceedings of 1981 National Conference on Environmental Engineering; American Society of Civil Engineers; Atlanta, Georgia; 1981.